PROPOSAL FORM

BALTIMORE COUNTY
DEPARTMENT OF PUBLIC WORKS & TRANSPORTATION
TOWSON, MARYLAND

Division of Construction Contracts Administration

ARCHITECT

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Contract Number 25034 PF0 Re-Bid
Property Management Project
Fullerton Fire Station #8 Ladies Renovation & Addition –
4401 Fitch Avenue, Nottingham, Maryland 21236
Fullerton – District 14c5
Workday Number
PROJ-200540012

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 May 21, 2025 at 10:00 a.m. EST via WebEx. *Phone-In* (Audio Only) 1-415-655-0001, Meeting Number 2306 251 0031##. *Video Conference* go to https://signin.webex.com/join Meeting Number 2306 251 0031,**Password**: **kJU6PjKpR26**, for Webex link go to: www.baltimorecountymd.gov/departments/public-works/engineering/contracts/current-solicitations

Baltimore County Prevailing Wage and Local Hiring Affidavit, Wage Rates & Requirements **see pages 1267-1274**
(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 1275-1289**

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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S E C T I O N 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 TRANSPORTATON 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 $640.00**.**

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.mmgcapitalgroup.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

INDEX GENERAL CONDITIONS
BUILDING PROJECTS

VII. LAWS, PERMITS, LICENSES, INSURANCE & BONDS

VIII. INSPECTION AND SURVEYS

IX. CONSTRUCTION

X. MISCELLANEOUS ADDENDA

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 down loading 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 <u>not</u> submit for approval, materials other than those specified without a written statement why such a <u>Substitution</u> 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

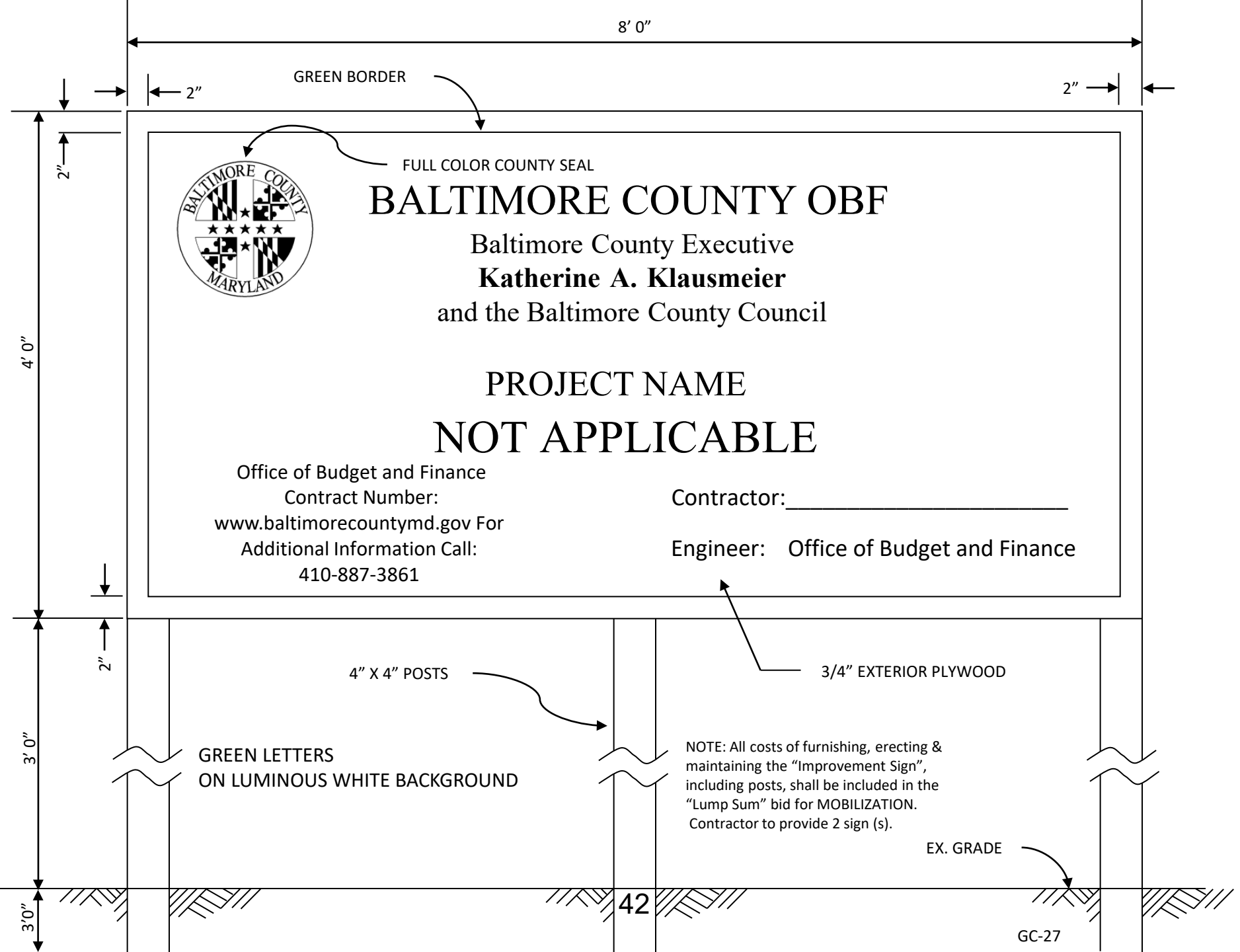
A. The Contractor shall erect and maintain upon the project site, and where directed by the Engineer, suitable offices for his/her own use and that of the Engineer.

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.


8’ 0”
GREEN BORDER
2”
2”
2”
FULL COLOR COUNTY SEAL
BALTIMORE COUNTY OBF
Baltimore County Executive
Katherine A. Klausmeier
and the Baltimore County Council
PROJECT NAME
NOT APPLICABLE
Office of Budget and Finance
Contract Number:
www.baltimorecountymd.gov For
Additional Information Call:
410-887-3861
Contractor:_____
Engineer: Office of Budget and Finance
4’ 0”
2”
3/4” EXTERIOR PLYWOOD
4” X 4” POSTS
3’ 0”
GREEN LETTERS
ON LUMINOUS WHITE BACKGROUND
NOTE: All costs of furnishing, erecting & maintaining the “Improvement Sign”, including posts, shall be included in the “Lump Sum” bid for MOBILIZATION.
Contractor to provide 2 sign (s).
EX. GRADE
3’0”
42
GC-27

PROJECT MANUAL

Contract No. 25034 PF0 RE-BID
Job Order No. 241-220-0054-0012

Baltimore County
Fullerton Fire Station No 8
Renovation and Addition

MWS Project No: 20-120

4401 Fitch Avenue
Nottingham, Maryland 21236

PREPARED FOR:

BALTIMORE COUNTY PROPERTY MANAGEMENT
12200 Long Green Pike
Glen Arm, MD 21057

Bid/Permit
March 1, 2025

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DOCUMENT 000101 - PROJECT TITLE PAGE

1.1 PROJECT MANUAL VOLUME 1

A. Fullerton Fire Station #8 - Renovation & Addition.

B. Baltimore County Property Management.

C. 4401 Fitch Avenue, Nottingham, Maryland, 21236

D. Architect Project No. 20-120.

E. Manns Woodward Studios Inc.

F. 10839 Philadelphia Road.

G. White Marsh, Maryland, 21162.

H. Phone: 410-344-1460.

I. Fax: 443-403-2460.

J. Issued: March 1, 2025.

END OF DOCUMENT 000101

DOCUMENT 000115 - LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

A. Drawings: Drawings consist of the Contract Drawings and other drawings listed in the DRAWING INDEX of the separately bound drawing set titled Fullerton Fire Station No 8 Renovation and Addition dated March 1, 2025, as modified by subsequent Addenda and Contract modifications.

END OF DOCUMENT 000115

DOCUMENT 003126 - EXISTING HAZARDOUS MATERIAL INFORMATION

1.1 EXISTING HAZARDOUS MATERIAL INFORMATION

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

END OF DOCUMENT 003126

Steve Gallatin
Capital Construction Project Specialist
Baltimore County
OBF-Property Management
12200A Long Green Pike
Glen Arm, Maryland 21057

July 3, 2024

RE: Asbestos, Lead, PCB, & Mold Inspection for Renovation of Fullerton Fire Station 8, Nottingham, MD
BEA # 1103624H

Mr. Gallatin:

In response to your request, BATTA ENVIRONMENTAL ASSOCIATES, INC. is pleased to present this report summarizing the findings of the requested Asbestos NESHAP, Lead, PCB, and mold Inspection and sampling of the areas impacted by the renovations at Fullerton Fire Station located at 441 Fitch Avenue in Nottingham, Maryland, in advance of the planned renovations.

On April 12th, 15th, and 16th, 2024, in response to your request, this investigation and sampling was performed by Justin Soliz, and Sharon Thompson, EPA certified and State of Maryland Asbestos Building Inspectors. These inspectors also investigated the areas for possible PCB containing materials, lead, and mold contaminated materials. This inspection and sampling provided the data contained in this report and is the basis for the summary of findings included here.

ASBESTOS

The asbestos survey performed was intrusive / destructive in nature since these structures are scheduled for renovation, but there may be hidden areas that were not observed since aggressive structural demolition and underground disturbance was not performed at this time. Only accessible materials were investigated. A visual inspection combined with representative bulk sampling was performed to verify the locations and to determine the asbestos content of the materials. A field drawing showing sample locations of suspect ACM was created.

The following suspected and sampled materials were found to be asbestos containing:

Fire station

➢ **Floor Tile**	**Dorm**	**2,500 SF**	**3% Chrysotile**	**non-friable**
➢ **Floor Tile**	**Locker Room**	**1,200 SF**	**3% Chrysotile**	**non-friable**
➢ **Soffit Cement Board**	**Exterior**	**1,700 SF**	**15% Chrysotile**	**non-friable**
➢ **Fascia Cement Board**	**Exterior**	**1,700 SF**	**15% Chrysotile**	**non-friable**

The following materials were suspected, sampled and found to have **No Asbestos Detected**:

Dorm
- Cove Base
- Ceiling tiles
- Window Caulk
- Heating Unit
- Pipe Jacket/Elbow
- Pipe Insulation
- Floor tile Mastic

Kitchen
- Pipe Jacket/Elbow
- Cove Base
- Ceiling tile
- Window Glazing Putty

Men's Locker Room
- Pipe Insulation
- Pipe Jacket/Elbow
- Pipe Jacket
- Caulk
- Floor tile Mastic

Women's Locker Room
- Drywall
- Ceiling tile
- Grout
- Joint Compound
- Caulk

Men's Shower Room
- Floor tile grout
- Wall Grout
- Wall Mastic

Men's Restroom
- Ceiling Plaster

Pantry
- Ceiling tile

Washer Room
- Tectum Ceiling
- Pipe Elbow
- Pipe Jacket
- Door Caulk

Laundry Room
- Drywall
- Joint Compound

Roof
- Roof Core
- Seam Caulk
- Surfaced Coating
- Conduit Penetration Caulk
- Metal Cap Caulk
- Duct Jacket

Women's Locker Room
- Drywall
- Ceiling tile
- Grout
- Joint Compound
- Caulk

Basement
- Pipe Jacket
- Elbow

Exterior
- Window Caulk

(Additional hidden materials may also exist inside concealed locations.)

Asbestos Bulk samples were analyzed using Polarized Light Microscopy (PLM), following standard protocol which stops analysis on subsequent samples (B, C, etc.) for a specific homogeneous material once a positive result is obtained for a previous sample (i.e. A). These numerous samples (A, B, C, D,.) of homogeneous materials are necessary in some cases to definitively identify a material as non-asbestos-containing with statistically significant confidence.

Prior to removal, demolition or any work impacting directly or indirectly on any material(s) identified as or suspected and not sampled and analyzed and therefor presumed to be asbestos containing, the known or presumed asbestos materials potentially impacted must be removed according to the regulations of the EPA and Maryland Department of Environment (MDE). Work on Asbestos materials requires specially trained and licensed workers, supervisors, and companies. (In addition to the specialized removal requirements,

there may also be a 10-day notification requirement to MDE / EPA prior to demolition.) Following the Asbestos removal a visual inspection (and air clearance testing if the space is to be occupied prior to demolition) must be performed and a final clearance letter issued by a professional service firm such as Batta, to certify that the identified asbestos materials have been completely removed and the area is ready for demolition (or re-occupancy).

Should suspect materials be uncovered during renovations that were not previously investigated or sampled, prior to any demolition or other work impacting directly or indirectly on suspect materials not tested, and therefore presumed to be asbestos containing, the presumed asbestos containing materials potentially impacted must be either tested and proven to be non-asbestos or removed as asbestos according to the regulations of the EPA and Maryland Department of Environment (MDE).

LEAD

Investigation of the lead content of the coatings on the materials being impacted by this renovation was performed with bulk paint chip sampling. The lead survey consisted of representative bulk paint samples from the various painted components with the scope of work. Bulk paint samples were analyzed by Atomic Absorption Spectroscopy (AAS) by Batta Laboratories.

Lead Based Paint is defined by HUD as paint that contains lead in concentrations greater than one milligram per square centimeter (1.0 mg/cm2) or 0.50% by weight. Lead in paint at any level is regulated under OSHA 29 CFR 1926.62 which applies to all construction work where an employee may be occupationally exposed to lead which includes the demolition or salvage of structures and torch cutting where lead or materials containing lead are present. Lead Based Paint was not identified, and Lead Containing Paint was identified, and **workers should be informed of the presence of lead and possess lead awareness training.** The **waste should be tested by Toxicity Characteristic Leaching Procedure (TCLP)** methods to confirm the waste is non-hazardous (for lead) prior to disposal.

Various painted surfaces were evaluated, and a visual assessment of the identified lead-based surfaces was performed. Identified lead-based paint components were visually assessed for paint condition as per the United States Department of Housing & Urban Development (HUD) guidelines.

The following items were sampled. **No existing lead-based paint was identified**

Fullerton-Fire Station					
Component	**Location**	**Color**	**Substrate**	**Condition**	**Lead (Pb) by % Weight**
Wall	Men's Locker Room	Tan	Drywall	Good	<0.0063
Wall	Men's Locker Room	Off-White	Drywall	Good	<0.0063
Wall	Women's Locker Room	Gray	Drywall	Good	<0.0063
Wall	Women's Locker Room	Gray	Drywall	Good	<0.0063

HUD guidelines define paints with 0.5% or greater by weight of lead as "lead-based paint.

PCBs

Investigation for PCBs was accomplished by bulk sampling of the suspect exterior building caulks and analyzing the samples by method SW846 8082A - PCBs by Gas Chromatography at ALS Environmental laboratory in Middletown, Pennsylvania None of the samples analyzed were found to contain concentrations of PCBs greater than 50 parts per million (ppm) which defines a material as a PCB bulk product waste under the Toxic Substances Control Act (TSCA) in 40 CFR 761.3. The following table summarizes the results of the PCB sampling.

Sample #	Location	Result
3356287001	Sidewalk Caulk	None Detected
3356287002	Concrete Expansion Joint	None Detected
3356287003	Ext. Window Caulk	None Detected
3356287004	Ext. Window Caulk	None Detected
3356287005	Ext. Window Caulk	None Detected
3356287006	Men's Locker Room Caulk	None Detected
3356287007	Men's Locker Room Caulk	None Detected
3356287008	Washer Room Caulk	None Detected
3356287009	Washer Room Caulk	None Detected

MOLD

Surface samples were secured using "Bio-Tape." Bio-Tape™ provides a standardized sampling method for the determination of mold, microbial, bioaerosol, and inorganic dust contamination. Bio-Tape consists of a flexible plastic microscope slide with a pre-defined adhesive area. A center-line marker on the slide aids the user in locating the center when taking the sample and also aids the laboratory analyst in finding the center of the sample. Each slide is provided with a unique serial number for traceability and packed in a slide mailer to prevent cross contamination.

Samples were couriered to Batta Laboratories, LLC located at 6 Garfield Way, in Newark, Delaware, an AIHA accredited laboratory, for analysis. The analysis of the samples consisted of the identification and enumeration of fungal structures through direct microscopic examination.

A summary of the results can be found in the table below.

Sample Number	Location	Mold Growth	Comment
B343-7047	Kitchen Ceiling tile 1	Alternaria (Rare)	Mold Growth
		Aspergillus/ Penicillium (High)	Mold Growth
		Epicoccum (Rare)	Mold Growth
		Cladosporium (High)	Mold Growth

Sample Number	Location	Mold Growth	Comment
B343-7047	Kitchen Ceiling tile 1	Spegazzinia (Rare)	Mold Growth
		Stachybotrys (Rare)	Mold Growth
B343-7032	Kitchen Ceiling tile 2	Alternaria (Rare)	Mold Growth
		Cladosporium (High)	Mold Growth
		Pithomyces/Ulocladium (Rare)	Mold Growth

Direct examination of the surface samples indicated mold contamination on the surface of the building material. The types and concentrations of mold that were identified are commonly associated with wet and water damaged materials.

I hope that this report conveys to you in brief format the findings of this investigation. Detailed documentation for the survey and laboratory Certificates of Analysis are attached following this letter. If you should have any questions, comments, or need additional services in the future, please call me at 302 737-3376

Sincerely,

Sharon Thompson
AHERA Project Manager
(O) 302.737.3376 | Sharon.Thompson@battaenv.com

Dedicated to a Cleaner Environment Since 1982

NY ELAP LAB# 11993 for PCM, PLM, TEM & Lead

batta LABORATORIES

BATTA LABORATORIES, LLC

A Certified MBE Company

Delaware Industrial Park, 6 Garfield Way
Newark, DE19713-5817
Tel. (302)737-3376 Fax (302) 737-5764

Web: http://www.battaenv.com E-mail: battaenv@battaenv.com

EPA Lab ID #DE004

NVLAP Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0
Batch#: N/A
COC#: N/A

CERTIFICATE OF PLM ANALYSIS

Test Method: EPA/600/R-93/116 in conjunction with Batta SOP

Report Date: 04/24/24

Sampling Data

Date Sampled: 04/12/24
BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481900	01-A	Washer Room	Tectum Ceiling	n/a	Firm Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481901	02-A	Washer Room	Tectum Ceiling	n/a	Firm Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481902	03-A	Washer Room	Pipe Elbow	n/a	Soft Homogeneous	Gray	30% Mineral Wool 70% Non-fibrous Material	No Asbestos Found
1481903	04-B	Washer Room	Pipe Elbow	n/a	Soft Homogeneous	Gray	30% Mineral Wool 70% Non-fibrous Material	No Asbestos Found
1481904	05-B	Washer Room	Pipe Elbow	n/a	Soft Homogeneous	Gray	30% Mineral Wool 70% Non-fibrous Material	No Asbestos Found

Note 1 *Due to limitations of the EPA PLM method, floor tiles may yield false negative (<1%) results by this method. As such, the EPA recommends further analysis by electron microscopy. Batta recommends the NY 198.4 over the Chatfield method.*

Note 2 Unless otherwise specified, Tr=Trace and correlates to <0.25% (based on a 400-point EPA point count).

Note 3 Materials containing vermiculite are not good candidates for analysis using standard EPA 600 PLM protocol. Results may be low-biased due to inherent limitations caused by the material. The EPA recommends that vermiculite attic insulation (VAI) be prepped and analyzed using EPA 600/R-04/004, known as "The Cincinnati Method".

ANALYST: JJF

REVIEWED BY: _____
QA/QC Officer/Signatory

Document Security Note: *Due to the unsecure nature of electronic files, it is the responsibility of the client (herein defined as the recipients of this or these electronic files) to verify the authenticity and accuracy of data included in the attached electronic file(s). Batta Laboratories, LLC is not liable for any discrepancies, alternations, reproduction (including copying and pasting), redistribution or any other actions that may alter or change the accuracy or the nature of the originally transmitted files. It is recommended that the recipient of these documents verify the data in electronic format with the corresponding hard copy data report.*

*This report does not constitute endorsement by NVLAP and/or any other US government agencies. PLM analyses do not fall under the purview of AIHA LAP.

*The test data pertain only to the items tested. No assumptions or conclusions should be made to materials or samples not analyzed. Furthermore, Batta Laboratories, LLC assumes no responsibility for the accuracy of results influenced by the use of improper collection techniques or equipment.

*Organically-bound, nonfriable material may interfere with the accurate and reproducible quantification of asbestos. In these cases, the EPA recommends further analysis by a matrix-reduction method. Batta recommends the NY ELAP Item 198.6/198.4 over the Chatfield method. When point count techniques are utilized on organically-bound, nonfriable materials without the EPA-recommended matrix reduction steps, Batta Laboratories assumes no responsibility regarding the accuracy or precision associated with these results. In these cases, Batta employs a modified version of the EPA point count method.

*WRTA refers to a group of fibrous Amphiboles typically associated with 'Libby Amphibole'. Within this classification are: winchite, richterite, tremolite, and actinolite.

Dedicated to a Cleaner Environment Since 1982

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Web: http://www.battaenv.com E-mail: battaenv@battaenv.com

EPA Lab ID #DE004

NVLAP Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0
Batch#: N/A
COC#: N/A

CERTIFICATE OF PLM ANALYSIS

Test Method: EPA/600/R-93/116 in conjunction with Batta SOP

Report Date: 04/24/24

Sampling Data

Date Sampled: 04/12/24
BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481905	06-B	Washer Room	Pipe Elbow	n/a	Soft Homogeneous	Gray	30% Mineral Wool 70% Non-fibrous Material	No Asbestos Found
1481906	07-B	Washer Room	Pipe Elbow	n/a	Soft Homogeneous	Gray	30% Mineral Wool 70% Non-fibrous Material	No Asbestos Found
1481907	08-B	Washer Room	Pipe Elbow	n/a	Soft Homogeneous	Gray	30% Mineral Wool 70% Non-fibrous Material	No Asbestos Found
1481908	09-C	Washer Room	Pipe Jacket	n/a	Fibrous Homogeneous	White Yellow	40% Synthetic Fiber 30% Fiber Glass 30% Non-fibrous Material	No Asbestos Found
1481909	10-C	Washer Room	Pipe Jacket	n/a	Fibrous Homogeneous	White Yellow	40% Synthetic Fiber 30% Fiber Glass 30% Non-fibrous Material	No Asbestos Found

Note 1 *Due to limitations of the EPA PLM method, floor tiles may yield false negative (<1%) results by this method. As such, the EPA recommends further analysis by electron microscopy. Batta recommends the NY 198.4 over the Chatfield method.*

Note 2 Unless otherwise specified, Tr=Trace and correlates to <0.25% (based on a 400-point EPA point count).

Note 3 Materials containing vermiculite are not good candidates for analysis using standard EPA 600 PLM protocol. Results may be low-biased due to inherent limitations caused by the material. The EPA recommends that vermiculite attic insulation (VAI) be prepped and analyzed using EPA 600/R-04/004, known as "The Cincinnati Method".

ANALYST: JJF

REVIEWED BY: _____
QA/QC Officer/Signatory

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NY ELAP LAB# 11993 for PCM, PLM, TEM & Lead

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EPA Lab ID #DE004

NVLAP Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0
Batch#: N/A
COC#: N/A

CERTIFICATE OF PLM ANALYSIS

Test Method: EPA/600/R-93/116 in conjunction with Batta SOP

Report Date: 04/24/24

Sampling Data

Date Sampled: 04/12/24
BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481910	11-C	Washer Room	Pipe Jacket	n/a	Fibrous Homogeneous	White Yellow	40% Synthetic Fiber 30% Fiber Glass 30% Non-fibrous Material	No Asbestos Found
1481911	12-C	Washer Room	Pipe Jacket	n/a	Fibrous Homogeneous	White Yellow	40% Synthetic Fiber 30% Fiber Glass 30% Non-fibrous Material	No Asbestos Found
1481912	13-C	Washer Room	Pipe Jacket	n/a	Fibrous Homogeneous	White Yellow	40% Synthetic Fiber 30% Fiber Glass 30% Non-fibrous Material	No Asbestos Found
1481913	14-C	Washer Room	Pipe Jacket	n/a	Fibrous Homogeneous	White Yellow	40% Synthetic Fiber 30% Fiber Glass 30% Non-fibrous Material	No Asbestos Found
1481914	15-C	Washer Room	Pipe Jacket	n/a	Fibrous Homogeneous	White Yellow	40% Synthetic Fiber 30% Fiber Glass 30% Non-fibrous Material	No Asbestos Found

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Rev. #: 0
Batch#: N/A
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CERTIFICATE OF PLM ANALYSIS

Test Method: EPA/600/R-93/116 in conjunction with Batta SOP

Report Date: 04/24/24

Sampling Data

Date Sampled: 04/12/24
BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481915	16-C	Washer Room	Pipe Jacket	n/a	Fibrous Homogeneous	White Yellow	40% Synthetic Fiber 30% Fiber Glass 30% Non-fibrous Material	No Asbestos Found
1481916	17-D	Washer Room	Door Caulk	n/a	Soft Homogeneous	Gray	100% Non-fibrous Material	No Asbestos Found
1481917	18-D	Washer Room	Door Caulk	n/a	Soft Homogeneous	Gray	100% Non-fibrous Material	No Asbestos Found
1481918	19-E	Laundry Room	Drywall/Joint Compound	n/a	Firm Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481919	19-E LAYER	Laundry Room	Texture	n/a	Soft Homogeneous	Gray	5% Cellulose 95% Non-fibrous Material	No Asbestos Found

Note 1 *Due to limitations of the EPA PLM method, floor tiles may yield false negative (<1%) results by this method. As such, the EPA recommends further analysis by electron microscopy. Batta recommends the NY 198.4 over the Chatfield method.*

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ANALYST: JJF

REVIEWED BY: _____

QA/QC Officer/Signatory

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EPA Lab ID #DE004

NVLAP® Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0
Batch#: N/A
COC#: N/A

CERTIFICATE OF PLM ANALYSIS

Test Method: EPA/600/R-93/116 in conjunction with Batta SOP

Report Date: 04/26/24

Sampling Data

Date Sampled: 04/12/24
BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data			Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/	Gross	Color	Non-asbestiform Components	Asbestiform Components
1481921	20-E	Laundry Room	Drywall/Joint Compound	n/a	Firm Homogeneous		White	100% Non-fibrous Material	No Asbestos Found
1481922	20-E LAYER	Laundry Room	Texture	n/a	Soft Homogeneous		Gray	5% Cellulose 95% Non-fibrous Material	No Asbestos Found
1481924	21-F	Dorm	Floor Tile	n/a	Firm Homogeneous		White	97% Non-fibrous Material	3% Chrysotile Total Asbestos = 3%
1481925	21-F LAYER	Dorm	Mastic	n/a	Soft Homogeneous		Black	100% Non-fibrous Material	No Asbestos Found
1481926	22-F **	Dorm	Floor Tile	n/a					Sample Not Analyzed (positive stop rules)

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ANALYST: JJF

REVIEWED BY: _____
QA/QC Officer/Signatory

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NVLAP Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0
Batch#: N/A
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CERTIFICATE OF PLM ANALYSIS

Test Method: EPA/600/R-93/116 in conjunction with Batta SOP

Report Date: 04/24/24

Sampling Data

Date Sampled: 04/12/24
BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481927	22-F LAYER	Dorm	Mastic	n/a	Soft Homogeneous	Black	100% Non-fibrous Material	No Asbestos Found
1481928	23-F **	Dorm	Floor Tile	n/a				Sample Not Analyzed (positive stop rules)
1481929	23-F LAYER	Dorm	Mastic	n/a	Soft Homogeneous	Black	100% Non-fibrous Material	No Asbestos Found
1481930	24-G	Dorm	Covebase	n/a	Firm Homogeneous	Brown	100% Non-fibrous Material	No Asbestos Found
1481931	25-G	Dorm	Covebase	n/a	Firm Homogeneous	Brown	100% Non-fibrous Material	No Asbestos Found

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CERTIFICATE OF PLM ANALYSIS

Test Method: EPA/600/R-93/116 in conjunction with Batta SOP

Report Date: 04/24/24

Sampling Data

Date Sampled: 04/12/24
BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481932	26-G	Dorm	Covebase	n/a	Firm Homogeneous	Brown	100% Non-fibrous Material	No Asbestos Found
1481933	27-G	Dorm	Covebase	n/a	Firm Homogeneous	Brown	100% Non-fibrous Material	No Asbestos Found
1481934	28-H	Dorm	Ceiling Tile	n/a	Fibrous Homogeneous	Gray	50% Cellulose 40% Mineral Wool 10% Non-fibrous Material	No Asbestos Found
1481935	29-H	Dorm	Ceiling Tile	n/a	Fibrous Homogeneous	Gray	50% Cellulose 40% Mineral Wool 10% Non-fibrous Material	No Asbestos Found
1481936	30-H	Dorm	Ceiling Tile	n/a	Fibrous Homogeneous	Gray	50% Cellulose 40% Mineral Wool 10% Non-fibrous Material	No Asbestos Found

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ANALYST: JJF

REVIEWED BY: _____

QA/QC Officer/Signatory

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BATTA Environmental

BULK SAMPLE DATA SHEET

L363624 1

PLM: ☐ EPA ☐ POINT COUNT ☐ NOB TEM: ☐ YES/NO ☐ NOB ☐ EPA NOTE TO ANALYST – POSITIVE STOP UNLESS OTHERWISE NOTED

Project Name: Fullerton Fire Station #8 BEA# 1103624 H Results Required: 4 / 23 / 24 HRS

Site Inspected / Address: 4401 Fitch Ave. Nottingham, MD 21236 Cert of Analysis Req: / / HRS

Inspector(s): Sharon Thompson Justin Soliz Results to: ☐ Inspector

B.I. #: EHSBIR 230601-0004 Date Inspected 4 / 12 / 24 ☐ Manager: ☐ Client:

SAMPLE NUMBER FIELD	SAMPLE NUMBER LAB 1481	MATERIAL SAMPLED Note 2	AHERA CLASS	Note1 CONDITION G / D / S / D		ALL LOCATIONS, Name & Circle Sample Locations (E.1, E.2 ,0.1, 1.1, 1.3, 2.2, ...)	MATERIAL QUANTITY	Note 3 SAMPLE COMPOSITION	SAMPLE COLOR	RESULTS %	RESULTS TYPE
1-A A, B, C	900	Tectum Ceiling			N F	Washer Room				NAD	–
2-A A, B, C		Tectum Ceiling			N F	Washer Room					
3-B A, B, C		Pipe Elbow			N F						
4-B A, B, C					N F						
5-B A, B, C					N F						
6-B A, B, C					N F						
7-B A, B, C					N F						
8-B A, B, C		Pipe Elbow			N F						
9-C A, B, C		Pipe Jacket			N F						
10-C A, B, C					N F						
11-C A, B, C					N F						
12-C A, B, C					N F						
13-C A, B, C					N F						
14-C A, B, C					N F						
15-C A, B, C	914	Pipe Jacket			N F	Washer Room				NAD	–

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Notes 1 AHERA Classification T=Thermal Insulation, S=Sprayed, M=Miscellaneous 2 Material Sampled Pipe Covering, Boiler Breeching, Ceiling Tile, Floor Tiles, Sheet Flooring, etc. 3 Sample Composition Homogeneous, Mixed Layered

Relinquished By: Date: / / Time: Received By: Date: 4.18.24 Time: 1500

Delivered By: Date: / / Time: Received By: Date: / / Time:

Delivered By: Date: / / Time: Received By: Date: / / Time:

BULK SAMPLE DATA SHEET

L363624

BATTA Environmental

PLM: EPA | POINT COUNT | NOB TEM: YES/NO | NOB EPA NOTE TO ANALYST – POSITIVE STOP UNLESS OTHERWISE NOTED

Project Name: Fullerton Fire Station #8 BEA# 1103624 H Results Required: 4 / 23 / 24 HRS

Site Inspected / Address: 4401 Fitch Ave, Nottingham, MD 21236 Cert of Analysis Req: / / HRS

Inspector(s): Sharon Thompson Justin Soltz Results to: Inspector

B.I. #: EHSBIR-230601-00009 Date Inspected 4 / 12 / 24 Manager:

Client:

SAMPLE NUMBER FIELD	SAMPLE NUMBER LAB	MATERIAL SAMPLED Note 2	AHERA CLASS	CONDITION G/D /S/D		ALL LOCATIONS, Name & Circle Sample Locations (E.1, E.2, O.1, 1.1, 1.3, 2.2, ...)	MATERIAL QUANTITY	SAMPLE COMPOSITION Note 3	SAMPLE COLOR	RESULTS %	RESULTS TYPE
16-C A, B, C	915	Pipe Sacker			N F	Washer Room				NAD	–
17-D A, B, C	916	Door Caulk			N F	"					
18-D A, B, C	917	Door Caulk			N F	Washer Room					
19-E A, B, C	918-919 920	= Texture, Drywall, Joint Comp			N F	Laundry Room					
20-E A, B, C	921-922 923	= Texture, Drywall, Joint Comp			N F	Laundry Room				NAD	–
21-F A, B, C	924-925	Floor Tile/Mastic			N F	Dorm				3%	Chry
22-F A, B, C	926-927	Floor Tile/Mastic			N F	"				Positive ~~Stop~~	
23-F A, B, C	928-929	Floor Tile/mastic			N F	"				+ Stop	
24-G A, B, C	930	Cove Base			N F	"				NAD	–
25-G A, B, C	"	Cove Base			N F	"					
26-G A, B, C	"	Cove Base			N F	"					
27-G A, B, C	"	Cove Base			N F	"					
28-H A, B, C	"	Ceiling Tile			N F	"					
29-H A, B, C	"	Ceiling Tile			N F	"					
30-H A, B, C	934	Ceiling Tile			N F	Dorm				NAD	–

Notes 1 AHERA Classification: T=Thermal Insulation, S=Surfacing, M=Miscellaneous 2 Material Sampled: Pipe Covering, Boiler Breeching, Ceiling Tile, Floor Tiles, Sheet Flooring, etc. 3 Sample Composition: Homogeneous, Mixed Layered

Relinquished By: Date: / / Time: Received By: KMR Date: 4.18.24 Time: 1500

Delivered By: Date: / / Time: Received By: Date: / / Time:

Delivered By: Date: / / Time: Received By: Date: / / Time:

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EPA Lab ID #DE004

NVLAP Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0
Batch#: N/A
COC#: N/A

CERTIFICATE OF PLM ANALYSIS

Test Method: EPA/600/R-93/116 in conjunction with Batta SOP

Report Date: 04/24/24

Sampling Data

Date Sampled: 04/12/24
BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481937	31-H	Dorm	Ceiling Tile	n/a	Soft Homogeneous	Gray	70% Cellulose 20% Mineral Wool 10% Non-fibrous Material	No Asbestos Found
1481938	32-H	Dorm	Ceiling Tile	n/a	Fibrous Homogeneous	Yellow White	90% Fiber Glass 10% Non-fibrous Material	No Asbestos Found
1481939	33-I	Dorm	Window Caulk	n/a	Soft Homogeneous	Brown	100% Non-fibrous Material	No Asbestos Found
1481940	34-I	Dorm	Window Caulk	n/a	Soft Homogeneous	Brown	100% Non-fibrous Material	No Asbestos Found
1481941	35-J	Dorm	Heating Unit	n/a	Soft Homogeneous	Black	100% Non-fibrous Material	No Asbestos Found

Note 1 *Due to limitations of the EPA PLM method, floor tiles may yield false negative (<1%) results by this method. As such, the EPA recommends further analysis by electron microscopy. Batta recommends the NY 198.4 over the Chatfield method.*

Note 2 Unless otherwise specified, Tr=Trace and correlates to <0.25% (based on a 400-point EPA point count).

Note 3 Materials containing vermiculite are not good candidates for analysis using standard EPA 600 PLM protocol. Results may be low-biased due to inherent limitations caused by the material. The EPA recommends that vermiculite attic insulation (VAI) be prepped and analyzed using EPA 600/R-04/004, known as "The Cincinnati Method".

ANALYST: JJF

REVIEWED BY: _____

QA/QC Officer/Signatory

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NY ELAP LAB# 11993 for PCM, PLM, TEM & Lead

batta LABORATORIES

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Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481942	36-J	Dorm	Heating Unit	n/a	Soft Homogeneous	Black	100% Non-fibrous Material	No Asbestos Found
1481943	37-K	Dorm	Pipe Insulation/Jacket/Elbow	n/a	Fibrous Homogeneous	Gray Yellow	40% Fiber Glass 30% Mineral Wool 20% Cellulose 10% Non-fibrous Material	No Asbestos Found
1481944	38-K	Dorm	Pipe Insulation/Jacket/Elbow	n/a	Fibrous Homogeneous	Gray Yellow	40% Fiber Glass 30% Mineral Wool 20% Cellulose 10% Non-fibrous Material	No Asbestos Found
1481945	39-K	Dorm	Pipe Insulation	n/a	Fibrous Homogeneous	Tan Yellow	25% Cellulose 50% Fiber Glass 25% Non-fibrous Material	No Asbestos Found
1481946	40-K	Dorm	Pipe Insulation	n/a	Fibrous Homogeneous	Tan Yellow	25% Cellulose 50% Fiber Glass 25% Non-fibrous Material	No Asbestos Found

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BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481947	41-K	Dorm	Pipe Insulation	n/a	Fibrous Homogeneous	Tan Yellow	25% Cellulose 50% Fiber Glass 25% Non-fibrous Material	No Asbestos Found
1481948	42-K	Dorm	Pipe Insulation	n/a	Fibrous Homogeneous	Tan Yellow	25% Cellulose 50% Fiber Glass 25% Non-fibrous Material	No Asbestos Found
1481949	43-L	Locker Room	Pipe Insulation	n/a	Fibrous Homogeneous	Tan Yellow	25% Cellulose 50% Fiber Glass 25% Non-fibrous Material	No Asbestos Found
1481950	44-L	Locker Room	Pipe Insulation	n/a	Fibrous Homogeneous	Tan Yellow	25% Cellulose 50% Fiber Glass 25% Non-fibrous Material	No Asbestos Found
1481951	45-L	Locker Room	Pipe Insulation	n/a	Fibrous Homogeneous	Tan Yellow	25% Cellulose 50% Fiber Glass 25% Non-fibrous Material	No Asbestos Found

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Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481952	46-L	Locker Room	Pipe Jacket/Elbow	n/a	Fibrous Homogeneous	Tan Yellow Gray	25% Cellulose 30% Mineral Wool 30% Fiber Glass 15% Non-fibrous Material	No Asbestos Found
1481953	47-L	Locker Room	Pipe Jacket	n/a	Fibrous Homogeneous	Tan Yellow	25% Cellulose 50% Fiber Glass 25% Non-fibrous Material	No Asbestos Found
1481954	48-L	Locker Room	Pipe Jacket	n/a	Fibrous Homogeneous	Tan Yellow	25% Cellulose 50% Fiber Glass 25% Non-fibrous Material	No Asbestos Found
1481955	49-M	Mens Restroom	Ceiling Plaster	n/a	Firm Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481956	50-M	Mens Restroom	Ceiling Plaster	n/a	Firm Homogeneous	White	100% Non-fibrous Material	No Asbestos Found

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Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481957	51-N	Locker Room	Caulk	n/a	Soft Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481958	52-N	Locker Room	Caulk	n/a	Soft Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481959	53-O	Locker Room	Floor Tile	n/a	Firm Homogeneous	White	97% Non-fibrous Material	3% Chrysotile Total Asbestos = 3%
1481960	53-O LAYER	Locker Room	Mastic	n/a	Soft Homogeneous	Black	100% Non-fibrous Material	No Asbestos Found
1481961	54-P	Mens Shower Room	Floor Tile Grout	n/a	Firm Homogeneous	Gray	100% Non-fibrous Material	No Asbestos Found

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Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481962	55-Q	Mens Shower Room	Wall Grout	n/a	Firm Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481963	56-R	Mens Shower Room	Wall Mastic	n/a	Firm Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481964	57-S	Kitchen	Ceiling Tile	n/a	Fibrous Homogeneous	White Yellow	90% Fiber Glass 10% Non-fibrous Material	No Asbestos Found
1481965	58-S	Kitchen	Ceiling Tile	n/a	Soft Homogeneous	Gray	60% Cellulose 30% Mineral Wool 10% Non-fibrous Material	No Asbestos Found
1481966	59-T	Pantry	Ceiling Tile	n/a	Fibrous Homogeneous	Yellow White	90% Fiber Glass 10% Non-fibrous Material	No Asbestos Found

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Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481967	60-U	Kitchen	Pipe Jacket/Elbow	n/a	Soft Homogeneous	Tan Yellow Gray	25% Cellulose 30% Fiber Glass 30% Mineral Wool 15% Non-fibrous Material	No Asbestos Found

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BULK SAMPLE DATA SHEET

L363624 2

BATTA Environmental

PLM: EPA | POINT COUNT | NOB TEM: YES/NO | NOB EPA NOTE TO ANALYST – POSITIVE STOP UNLESS OTHERWISE NOTED

Project Name: Fullerton Fire Station #8 BEA# 1103624 H Results Required: 4 / 23 / 24 HRS

Site Inspected / Address: 4401 Fitch Ave. Nottingham, MD 21236 Cert of Analysis Req: / / HRS

Inspector(s): Sharon Thompson Justin Soliz Results to: Inspector

B.I. #: EHSBIR-230601-00009 Date Inspected 4/12/24 Manager:

Client:

SAMPLE NUMBER FIELD	SAMPLE NUMBER LAB 1481	MATERIAL SAMPLED Note 2	AHERA CLASS	Note1 CONDITION G/D /S /D		ALL LOCATIONS, Name & Circle Sample Locations (E.1, E.2 ,0.1, 1.1, 1.3, 2.2, ...)	MATERIAL QUANTITY	Note 3 SAMPLE COMPOSITION	SAMPLE COLOR	RESULTS %	RESULTS TYPE
31-H A, B, C	937	Ceiling Tile			N F	Dorm				NAD	-
32-H A, B, C		Ceiling Tile			N F	Dorm					
33-I A, B, C		Window Caulk			N F	Dorm					
34-I A, B, C		Window Caulk			N F	Dorm					
35-J A, B, C		Heating Unit			N F	Dorm					
36-J A, B, C		Heating Unit			N F	Dorm					
37-K A, B, C		Pipe Insulation /Socket/Elbow			N F	Dorm					
38-K A, B, C		Pipe Insulation /Socket/Elbow			N F	Dorm					
39-K A, B, C		Pipe Insulation			N F	Dorm					
40-K A, B, C		Pipe Insulation			N F	Dorm					
41-K A, B, C		Pipe Insulation			N F	Dorm					
42-K A, B, C		Pipe Insulation			N F	Dorm					
43-L A, B, C		~~Locker Room~~ Pipe Insulation			N F	Locker Room					
44-L A, B, C		Pipe Insulation			N F	Locker Room					
45-L A, B, C	951	Pipe Insulation			N F	Locker Room				NAD	-

Notes 1 AHERA Classification T=Thermal Insulation, S=Surfacing, M=Miscellaneous 2 Material Sampled Pipe Covering, Boiler Breeching, Ceiling Tile, Floor Tiles, Sheet Flooring, etc. 3 Sample Composition Homogeneous, Mixed Layered

Relinquished By: Date: / / Time: Received By: KyR Date: 4/18/24 Time: 1500

Delivered By: Date: / / Time: Received By: Date: / / Time:

Delivered By: Date: / / Time: Received By: Date: / / Time:

BULK SAMPLE DATA SHEET

L3636242

BATTA Environmental

PLM: | EPA | POINT COUNT | NOB TEM: | YES/NO | NOB | EPA NOTE TO ANALYST – POSITIVE STOP UNLESS OTHERWISE NOTED

Project Name: Fullerton Fire Station #8 BEA# 1103624 H Results Required: 4 / 23 / 24 HRS

Site Inspected / Address: 4401 Fitch Ave, Nottingham, MD 21236 Cert of Analysis Req: / / HRS

Inspector(s): Sharon Thompson Justin Soliz Results to: Inspector

B.I. #: EHSBIR-230601-00009 Date Inspected / / Manager:

Client :

SAMPLE NUMBER FIELD	SAMPLE NUMBER LAB 1481	MATERIAL SAMPLED Note 2	AHERA CLASS	Note1 CONDITION G / D / S D		ALL LOCATIONS, Name & Circle Sample Locations (E.1, E.2, 0.1, 1.1, 1.3, 2.2, ...)	MATERIAL QUANTITY	Note 3 SAMPLE COMPOSITION	SAMPLE COLOR	RESULTS %	RESULTS TYPE
46-A, B, C	952	Pipe Jacket / Elbow			N F	Locker Room				NAD	–
47-A, B, C L		Pipe Jacket			N F	Locker Room					
48-A, B, C L		Pipe Jacket			N F	Locker Room					
49-A, B, C m		* Ceiling Plaster			N F	mens Restroom					
50-A, B, C m		* Ceiling Plaster			N F	mens Restroom					
51-A, B, C N		~~Floor Tile/mastic~~ Caulk			N F	~~Mens~~ Locker Room					
52-A, B, C N	958	Caulk			N F	Locker Room				NAD	–
53-A, B, C O	959-960	Floor Tile/mastic			N F	Locker Room				3%	Chry
54-A, B, C P	961	Floor Tile Grout			N F	mens Shower Room				NAD	–
55-A, B, C Q		Wall Grout			N F	mens Shower Room					
56-A, B, C R		Wall mastic			N F	mens shower Room					
57-A, B, C S		Ceiling Tile			N F	Kitchen					
58-A, B, C S		Ceiling Tile			N F	Kitchen					
59-A, B, C T		Ceiling Tile			N F	Pantry					
60-A, B, C U	967	Pipe Jacket / Elbow			N F	Kitchen				NAD	–

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EPA Lab ID #DE004

NVLAP Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0
Batch#: N/A
COC#: N/A

CERTIFICATE OF PLM ANALYSIS

Test Method: EPA/600/R-93/116 in conjunction with Batta SOP

Report Date: 04/24/24

Sampling Data

Date Sampled: 04/15/24
BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481968	61-U	Kitchen	Pipe Jacket/Elbow	n/a	Fibrous Homogeneous	Tan Gray Yellow	20% Cellulose 40% Fiber Glass 30% Mineral Wool 10% Non-fibrous Material	No Asbestos Found
1481969	62-V	Kitchen	Covebase	n/a	Firm Homogeneous	Gray	100% Non-fibrous Material	No Asbestos Found
1481970	63-V	Kitchen	Covebase	n/a	Firm Homogeneous	Gray	100% Non-fibrous Material	No Asbestos Found
1481971	64-W	Womens Locker Room	Ceiling Tile	n/a	Soft Homogeneous	Gray	70% Cellulose 20% Mineral Wool 10% Non-fibrous Material	No Asbestos Found
1481972	65-W	Womens Locker Room	Ceiling Tile	n/a	Soft Homogeneous	Gray Brown	15% Cellulose 85% Non-fibrous Material	No Asbestos Found

Note 1 *Due to limitations of the EPA PLM method, floor tiles may yield false negative (<1%) results by this method. As such, the EPA recommends further analysis by electron microscopy. Batta recommends the NY 198.4 over the Chatfield method.*

Note 2 Unless otherwise specified, Tr=Trace and correlates to <0.25% (based on a 400-point EPA point count).

Note 3 Materials containing vermiculite are not good candidates for analysis using standard EPA 600 PLM protocol. Results may be low-biased due to inherent limitations caused by the material. The EPA recommends that vermiculite attic insulation (VAI) be prepped and analyzed using EPA 600/R-04/004, known as "The Cincinnati Method".

ANALYST: JJF

REVIEWED BY: _____

QA/QC Officer/Signatory

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Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481973	66-X	Womens Locker Room	Grout	n/a	Firm Homogeneous	Gray	100% Non-fibrous Material	No Asbestos Found
1481974	67-X	Womens Locker Room	Grout	n/a	Firm Homogeneous	Gray	100% Non-fibrous Material	No Asbestos Found
1481975	68-Y	Womens Locker Room	Drywall	n/a	Soft Homogeneous	Gray Brown	15% Cellulose 85% Non-fibrous Material	No Asbestos Found
1481976	68-Y LAYER	Womens Locker Room	Joint Compound	n/a	Firm Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481977	69-Y	Womens Locker Room	Drywall	n/a	Soft Homogeneous	Gray Brown	15% Cellulose 85% Non-fibrous Material	No Asbestos Found

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Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481978	69-Y LAYER	Womens Locker Room	Joint Compound	n/a	Firm Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481979	70-Z	Womens Locker Room	Caulk	n/a	Soft Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481980	71-Z	Womens Locker Room	Caulk	n/a	Soft Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481981	72-AA	Basement	Pipe Jacket/Elbow	n/a	Fibrous Homogeneous	Tan Yellow Gray	20% Synthetic Fiber 30% Fiber Glass 30% Mineral Wool 20% Non-fibrous Material	No Asbestos Found
1481982	73-AA	Basement	Pipe Jacket/Elbow	n/a	Fibrous Homogeneous	Tan Yellow Gray	20% Synthetic Fiber 30% Fiber Glass 30% Mineral Wool 20% Non-fibrous Material	No Asbestos Found

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EPA Lab ID #DE004

NVLAP® Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0
Batch#: N/A
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BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481983	74-AA	Basement	Pipe Jacket/Elbow	n/a	Fibrous Homogeneous	Tan Yellow Gray	20% Synthetic Fiber 30% Fiber Glass 30% Mineral Wool 20% Non-fibrous Material	No Asbestos Found
1481984	75-AA	Basement	Pipe Jacket/Elbow	n/a	Fibrous Homogeneous	Tan Yellow Gray	20% Synthetic Fiber 30% Fiber Glass 30% Mineral Wool 20% Non-fibrous Material	No Asbestos Found
1481985	76-BB	Exterior	Window Caulk	n/a	Soft Homogeneous	Brown	100% Non-fibrous Material	No Asbestos Found
1481986	77-BB	Exterior	Window Caulk	n/a	Soft Homogeneous	Brown	100% Non-fibrous Material	No Asbestos Found
1481987	78-BB	Exterior	Window Caulk	n/a	Soft Homogeneous	Brown	100% Non-fibrous Material	No Asbestos Found

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EPA Lab ID #DE004

NVLAP Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0
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CERTIFICATE OF PLM ANALYSIS

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Report Date: 04/24/24

Sampling Data

Date Sampled: 04/15/24
BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID			Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#		Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481988	79-CC		Exterior	Soffit Cement Board	n/a	Firm Homogeneous	Gray	85% Non-fibrous Material	15% Chrysotile Total Asbestos = 15%
1481989	80-CC	**	Exterior	Soffit Cement Board	n/a				Sample Not Analyzed (positive stop rules)
1481990	81-DD		Exterior	Fascia Cement Board	n/a	Firm Homogeneous	Gray	85% Non-fibrous Material	15% Chrysotile Total Asbestos = 15%
1481991	82-DD	**	Exterior	Fascia Cement Board	n/a				Sample Not Analyzed (positive stop rules)
1481992	83-EE		Roof	Roof Core	n/a	Firm Homogeneous	Black White	20% Fiber Glass 80% Non-fibrous Material	No Asbestos Found

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** This sample was not analyzed for reasons noted in the far right column. Batta Labs, LLC will not charge clients for samples not analyzed. Please contact Batta if charged in error.

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Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481993	84-EE	Roof	Roof Core	n/a	Firm Homogeneous	Black White	20% Fiber Glass 80% Non-fibrous Material	No Asbestos Found
1481994	85-FF	Roof	Seam Caulk	n/a	Soft Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481995	86-FF	Roof	Seam Caulk	n/a	Soft Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481996	87-GG	Roof	Surfaced Coating	n/a	Soft Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1481997	88-GG	Roof	Surfaced Coating	n/a	Soft Homogeneous	White	100% Non-fibrous Material	No Asbestos Found

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Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1481998	89-HH	Roof	Surfaced Coating	n/a	Soft Homogeneous	Black	20% Cellulose 80% Non-fibrous Material	No Asbestos Found
1481999	90-HH	Roof	Surfaced Coating	n/a	Soft Homogeneous	Black	20% Cellulose 80% Non-fibrous Material	No Asbestos Found
1482000	91-II	Roof	Conduit Penetration Caulk	n/a	Firm Homogeneous	Black	100% Non-fibrous Material	No Asbestos Found
1482001	92-II	Roof	Conduit Penetration Caulk	n/a	Soft Homogeneous	Gray	100% Non-fibrous Material	No Asbestos Found
1482002	93-JJ	Roof	Metal Cap Caulk	n/a	Soft Homogeneous	Gray	100% Non-fibrous Material	No Asbestos Found

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*Organically-bound, nonfriable material may interfere with the accurate and reproducible quantification of asbestos. In these cases, the EPA recommends further analysis by a matrix-reduction method. Batta recommends the NY ELAP Item 198.6/198.4 over the Chatfield method. When point count techniques are utilized on organically-bound, nonfriable materials without the EPA-recommended matrix reduction steps, Batta Laboratories assumes no responsibility regarding the accuracy or precision associated with these results. In these cases, Batta employs a modified version of the EPA point count method.

*WRTA refers to a group of fibrous Amphiboles typically associated with 'Libby Amphibole'. Within this classification are: winchite, richterite, tremolite, and actinolite.

Dedicated to a Cleaner Environment Since 1982

NY ELAP LAB# 11993 for PCM, PLM, TEM & Lead

batta LABORATORIES

BATTA LABORATORIES, LLC

A Certified MBE Company

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Newark, DE19713-5817
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Web: http://www.battaenv.com E-mail: battaenv@battaenv.com

EPA Lab ID #DE004

NVLAP® Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0
Batch#: N/A
COC#: N/A

CERTIFICATE OF PLM ANALYSIS

Test Method: EPA/600/R-93/116 in conjunction with Batta SOP

Report Date: 04/24/24

Sampling Data

Date Sampled: 04/15/24
BLI Project #: L363624
Sampled By: S.THOMPSC
Project Name: 1103624H FULLERTON FIRESTATION #8 - 4401 FITCH AVE., NOTTINGHAM,MD
Date Analyzed: 04/23/24

Sample ID		Client-supplied Data			Analytical Data		Reported Results	
Lab Sample#	Client Sample#	Sample Description	Material Type	Friable?	Texture/ Gross	Color	Non-asbestiform Components	Asbestiform Components
1482003	94-JJ	Roof	Metal Cap Caulk	n/a	Soft Homogeneous	White	100% Non-fibrous Material	No Asbestos Found
1482004	95-KK	Roof	Duct Jacket	n/a	Fibrous Soft Homogeneous	Black Gray Yellow	15% Fiber Glass 85% Non-fibrous Material	No Asbestos Found

Note 1 *Due to limitations of the EPA PLM method, floor tiles may yield false negative (<1%) results by this method. As such, the EPA recommends further analysis by electron microscopy. Batta recommends the NY 198.4 over the Chatfield method.*

Note 2 Unless otherwise specified, Tr=Trace and correlates to <0.25% (based on a 400-point EPA point count).

Note 3 Materials containing vermiculite are not good candidates for analysis using standard EPA 600 PLM protocol. Results may be low-biased due to inherent limitations caused by the material. The EPA recommends that vermiculite attic insulation (VAI) be prepped and analyzed using EPA 600/R-04/004, known as "The Cincinnati Method".

ANALYST: JJF

REVIEWED BY: _____
QA/QC Officer/Signatory

Document Security Note: *Due to the unsecure nature of electronic files, it is the responsibility of the client (herein defined as the recipients of this or these electronic files) to verify the authenticity and accuracy of data included in the attached electronic file(s). Batta Laboratories, LLC is not liable for any discrepancies, alternations, reproduction (including copying and pasting), redistribution or any other actions that may alter or change the accuracy or the nature of the originally transmitted files. It is recommended that the recipient of these documents verify the data in electronic format with the corresponding hard copy data report.*

*This report does not constitute endorsement by NVLAP and/or any other US government agencies. PLM analyses do not fall under the purview of AIHA LAP.

*The test data pertain only to the items tested. No assumptions or conclusions should be made to materials or samples not analyzed. Furthermore, Batta Laboratories, LLC assumes no responsibility for the accuracy of results influenced by the use of improper collection techniques or equipment.

*Organically-bound, nonfriable material may interfere with the accurate and reproducible quantification of asbestos. In these cases, the EPA recommends further analysis by a matrix-reduction method. Batta recommends the NY ELAP Item 198.6/198.4 over the Chatfield method. When point count techniques are utilized on organically-bound, nonfriable materials without the EPA-recommended matrix reduction steps, Batta Laboratories assumes no responsibility regarding the accuracy or precision associated with these results. In these cases, Batta employs a modified version of the EPA point count method.

*WRTA refers to a group of fibrous Amphiboles typically associated with 'Libby Amphibole'. Within this classification are: winchite, richterite, tremolite, and actinolite.

BULK SAMPLE DATA SHEET

L3603624 3

ATTA Environmental

PLM: EPA | POINT COUNT | NOB TEM: YES/NO | NOB EPA NOTE TO ANALYST – POSITIVE STOP UNLESS OTHERWISE NOTED

Project Name: Fullerton Fire Station #8 BEA# 1103624 H Results Required: 4 / 23 / 24 HRS

Site Inspected / Address: 4401 Erich Ave. Nottingham, MD 21236 Cert of Analysis Req: / / HRS

Inspector(s): Sharon Thompson Joshua Soliz Results to: Inspector

B.I. #: EHSBLR-230601-00009 Date Inspected 4 / 15 / 24 Manager:

Client:

SAMPLE NUMBER FIELD	SAMPLE NUMBER LAB 1441	MATERIAL SAMPLED Note 2	AHERA CLASS	CONDITION Note1 G/D /S .D		ALL LOCATIONS, Name & Circle Sample Locations (E.1, E.2 ,0.1, 1.1, 1.3, 2.2, ...)	MATERIAL QUANTITY	SAMPLE Note 3 COMPOSITION	SAMPLE COLOR	RESULTS %	RESULTS TYPE
61-U A, B, C	968	Pipe Jacket/Elbow			N F	Kitchen				NAD	-
62-V A, B, C		Cove Base			N F	Kitchen					
63-V A, B, C		Cove Base			N F	Kitchen					
64-W A, B, C		Ceiling Tile			N F	Womens Locker Room					
65-W A, B, C		Ceiling Tile			N F	Womens Locker Room					
66-X A, B, C		Grout			N F	Womens Locker Room					
67-X A, B, C	974	Grout			N F	Womens Locker Room					
68-Y A, B, C	975 976	Drywall/Joint Comp			N F	Womens Locker Room					
69-Y A, B, C	977 978	Drywall/Joint Comp			N F	Womens Locker Room					
70-Z A, B, C	979	Caulk			N F	Womens Locker Room					
71-Z A, B, C		Caulk			N F	Womens Locker Room					
72-AA A, B, C		Pipe Jacket/Elbow			N F	Basement					
73-AA A, B, C					N F						
74-AA A, B, C					N F						
75-AA A, B, C	984	Pipe Jacket/Elbow			N F	Basement				NAD	-

Notes 1 AHERA Classification T=Thermal Insulation, S=Surfacing, M=Miscellaneous 2 Material Sampled Pipe Covering, Boiler Breeching, Ceiling Tile, Floor Tiles, Sheet Flooring, etc 3 Sample Composition Homogeneous, Mixed Layered

Relinquished By: Date: / / Time: Received By: Date: 4/18/24 Time: 1520

Delivered By: Date: / / Time: Received By: Date: / / Time:

Delivered By: Date: / / Time: Received By: Date: / / Time:

BATTA Environmental

BULK SAMPLE DATA SHEET

L363624 3

PLM: EPA | POINT COUNT | NOB TEM: YES/NO | NOB EPA NOTE TO ANALYST – POSITIVE STOP UNLESS OTHERWISE NOTED

Project Name: Fullerton Fire Station #8 BEA# 110362 4H

Site Inspected / Address: 4401 Fitch Ave, Nottingham, MD 21236

Inspector(s): Sharon Thompson, Justin Soliz

B.I. #: EHSBIR-230601-00009

Date Inspected 4/15/24

Results Required: 4/23/24 HRS

Cert of Analysis Req: / / HRS

Results to: Inspector Manager: Client:

SAMPLE NUMBER FIELD	SAMPLE NUMBER LAB M81	MATERIAL SAMPLED Note 2	AHERA CLASS	Note 1 CONDITION G/D /S /D	NF	ALL LOCATIONS, Name & Circle Sample Locations (E.1, E.2, 0.1, 1.1, 1.3, 2.2, ...)	MATERIAL QUANTITY	Note 3 SAMPLE COMPOSITION	COLOR	RESULTS %	RESULTS TYPE
76 ~~OR~~ A, B, C	985	Window Caulk			N F	Exterior				NAD	-
77 A, B, C BB		Window Caulk			N F	Exterior				1	1
78 A, B, C BB		Window Caulk			N F	Exterior				NAD	-
79 A, B, C CC		Soffit Cement Board			N F	Exterior				15%	Chry
80 A, B, C CC		" "			N F	Exterior				1	1
81 A, B, C DD		Fascia Cement Board			N F	Exterior				15%	Chry
82 ~~84~~ A, B, C DD		" "			N F	Exterior				+	Stop
83 A, B, C EE		Roof Core			N F	Roof				NAD	-
84 A, B, C EE		" "			N F	Roof					
85 A, B, C FF		Seam Caulk			N F	Roof					
86 A, B, C FF		Seam Caulk			N F	Roof					
87 A, B, C GG		White Surface Coating			N F	Roof					
88 A, B, C GG		White Surface Coating			N F	Roof					
89 A, B, C HH		Black tar Coating			N F	Roof					
90 A, B, C HH	999	Black tar Coating			N F	Roof				NAD	-

Notes 1 AHERA Classification T=Thermal Insulation, S=Surfacing, M=Miscellaneous 2 Material Sampled: Pipe Covering, Boiler Breeching, Ceiling Tile, Floor Tiles, Sheet Flooring, etc 3 Sample Composition Homogeneous, Layered

Relinquished By: _____ Date: / / Time: _____ Received By: KyR Date: 4/16/24 Time: 1520

Delivered By: _____ Date: / / Time: _____ Received By: _____ Date: / / Time: _____

Delivered By: _____ Date: / / Time: _____ Received By: _____ Date: / / Time: _____

BATTA Environmental

BULK SAMPLE DATA SHEET

L363624 3

PLM: EPA | POINT COUNT | NOB TEM: YES/NO | NOB EPA NOTE TO ANALYST – POSITIVE STOP UNLESS OTHERWISE NOTED

Project Name: Fullerton Fire Station #8 BEA# 1103624 H

Site Inspected / Address: 4401 Finch Ave. Nottingham, MD 21236

Inspector(s): Sharon Thompson Justin Soliz

B.I. #: EMBIR-230601-00009

Date Inspected 4/16/24

Results Required: 4/23/24 HRS

Cert of Analysis Req: / / HRS

Results to: Inspector Manager: Client:

SAMPLE NUMBER FIELD	SAMPLE NUMBER LAB (482)	MATERIAL SAMPLED Note 2	AHERA CLASS	Note 1 CONDITION G/D /S/D		ALL LOCATIONS, Name & Circle Sample Locations (E.1, E.2, 0.1, 1.1, 1.3, 2.2, ...)	MATERIAL QUANTITY	Note 3 SAMPLE COMPOSITION	COLOR	RESULTS %	RESULTS TYPE
1-II A, B, C	000	Conduit Penetration Caulk			NF	Roof				NAD	—
2-II A, B, C	001	"			NF	Roof					
3-JJ A, B, C	002	metal Cap Caulk			NF	Roof					
4-~~JJ~~ A, B, C	003	metal Cap Caulk			NF	Roof					
5-KK A, B, C	004	Duct Jacket			NF	Roof				NAD	—
A, B, C					NF						
A, B, C					NF						
A, B, C					NF						
A, B, C					NF						
A, B, C					NF						
A, B, C					NF						
A, B, C					NF						
A, B, C					NF						
A, B, C					NF						
A, B, C					NF						

85

Notes 1 AHERA Classification T=Thermal Insulation, S=Surfacing, M=Miscellaneous 2 Material Sampled: Pipe Covering, Boiler Breeching, Ceiling Tile, Floor Tiles, Sheet Flooring, etc. 3 Sample Composition Homogeneous, Mixed Layers

Relinquished By: Date: / / Time: Received By: Date: 4/18/24 Time: 1500

Delivered By: Date: / / Time: Received By: Date: / / Time:

Delivered By: Date: / / Time: Received By: Date: / / Time:

RP24042314

Dedicated to a Cleaner Environment Since 1982

NY ELAP# 11993
PCM, PLM, TEM & LEAD

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EPA Lab ID #DE004

NVLAP Lab Code: 101032-D

REPORT OF ANALYSIS

Report#: RP24042314
Project Number: 240419003
Project Name: Batta Environmental Associates
Project Location: 4401 Fitch Ave. Nottingham, MD 21236
Date Received: 04/19/2024
Date Analyzed: 04/23/2024
Analyte Requested: Lead
Date Sampled: 04/15/2024
Sampled By: J. Soliz
Date Report Issued: 04/23/2024

Lab Sample #	Field Sample #	Sample Description	Parameters	Results (mg/kg)	Result(% Weight)	Method	Reporting Limit (mg/kg)	Reporting Limit %Weight
240419003.001	01	1-A Men's Locker Room Wall -Tan	Lead	<63	<0.0063	Test Method: EPA 3050B/7000B	63	0.0063
240419003.002	02	2-A Men's Locker Room Wall -Off White	Lead	<63	<0.0063	Test Method: EPA 3050B/7000B	63	0.0063
240419003.003	03	3-B Women's Locker Room Wall -Gray	Lead	<63	<0.0063	Test Method: EPA 3050B/7000B	63	0.0063
240419003.004	04	4-B Women's Locker Room Wall -Grey	Lead	<63	<0.0063	Test Method: EPA 3050B/7000B	63	0.0063

* Material submitted was below the minimum amount required.
Note: 1. EPA guidelines require identification of paint samples as "lead based paint" when concentrations are found to be greater than 0.5% by weight; 2. Quality control results in this report are acceptable; 3. Results relate only to the items tested (on a dry weight basis); Batta Laboratories, LLC is not responsible for sample collection, nor interpretations made by others; 4. This report does not constitute endorsement by AIHA-LAP, LLC., NVLAP and/or any other U.S. governmental agencies; 5. Lab results/calculations are reported in 2 significant figures. Clients data/measurements are reported as they were submitted. Samples received in acceptable condition unless otherwise noted. 6. The designation of "CL" as the Analyst on this report denotes that there are samples listed above which were submitted to an accredited partner lab for analysis. 8. This report must not be reproduced without the written approval of BATTA Laboratories.

Batta Lab strives on customer feedback to improve the quality of our services. Please e-mail your feedback to feedback@battaenv.com.

Analyst: Sarah Hopkins

QA/QC BY:
N.C. Batta/A.Lewis (QA/QC Officer)

batta LABORATORIES
NVLAP Lab Code: 101032-0

Corporate Headquarters
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Web: https://battaenv.com

NVLAP: 101032
AIHA LAP, LLC: 100448
NY ELAP: 11993
EPA Lab: DE004
MD Lab: 263

CHAIN OF CUSTODY

BL Project # : L3637624

Customer Billing Information	Shipping Information	Turnaround Times (check one, refer to notes*)	Method of Payment
Name:	☐ Picked up by BATTA	☐ 6 Hours / Rush (*Note 1)	☐ Cash
Billing Address 1:	☐ Delivered by customer	☐ 24 Hours (*Note 2)	☐ Visa/MasterCard/Discover
Billing Address 2:	☐ Shipped by customer	☐ 48 Hours (*Note 3)	☐ Money Order
Phone:		☒ 72 Hours (*Note 4)	☐ Purchase Order #
Email:		☐ 5 Days (*Note 5)	☐ Check #
Results To:		☐ 5-10 Days (*Note 6, For Specialty Chem. Samples)	☐ Other
			☐ Unit Price/Quote
			☐ Total Payment
			☐ Reference #:

*** Notes Regarding Turnaround Times (TATs)**

Specific TATs depend on the test requested. TATs may not be available for all types of analysis.

*Note 1: Client must make arrangements with lab to guarantee 6 Hour/RUSH TAT - Call 1 (855)-862-2882
*Note 2: Unless a specific time is requested, results are guaranteed by 5pm on the following business day.
*Note 3: Unless a specific time is requested, results are guaranteed by 5pm on the 2nd business day.
*Note 4: Unless a specific time is requested, results are guaranteed by 5pm on the 3nd business day.
*Note 5: Unless a specific time is requested, results are guaranteed by 5pm on the 5th business day.
*Note 6: Unless a specific time is requested, results are guaranteed by 5pm on the 10th business day.

240419003

Client Project Information

Project Name:	Project Location:	If solid waste, will results be used for disposal in NJ? Yes ☐ No ☐	Project #:	Sampled By:
Fullerton Firestation #8	4401 Fitch Ave. Nottingham MD 21236	Were the samples collected in New York state? Yes ☐ No ☐	BEA#110362#H	Justin Soliz

Sample Information

Lab Use Only	Field Sample ID#	Sample Location & Description	Sampling Date & Time	Sampling Info for Air /Surface Samples: Start Time	Stop Time	Flow Rate	Volume/Area	Sample Type	Test Method	Laboratory Use Only: Results	Date of Analysis	Analyst
01	1-A	mens lockeroom Wall-Tan	4/15/24					PBchips	AAS			
02	2-A	mens Lockeroom Wall - offwhite	↓					↓	↓			
03	3-B	Women's Lockeroom Wall - Grey										
04	4-B	Women Lockeroom wall - gray										

Special Instructions From Client:

Sample Relinquished By: X	Date: 4/18/24	Time: 1:45pm	
Sample Received By: JEF	Date: 4/18/24	Time: 1430	

Laboratory Use Only

Logged-in by:	Log-in Date:	Date:	Field Samples Acceptable ☐ Yes ☐ No ☐ On Ice
			Sample #:
			Sample Condition:

For drinking water samples: for results to be valid, lab must receive samples on ice and within 48 hours of collection. For air samples collected by NIOSH 7400 and 7402: in accordance with these NIOSH methods, two field blanks, (or 10% of the number of field samples submitted, whichever is greater) must be submitted and be analyzed with field samples.

For solid waste samples: Before solid waste materials such as soil, ash, sludge, dredge spoils, etc. are disposed in New Jersey, they must undergo analysis following TCLP protocol. BATTA Labs is not responsible for waste disposal misrepresentations on this document. Document Control Item AM5

REV: 21-11-19

Main Site: 301 Fulling Mill Road | Middletown, PA 17057 | Phone: 717-944-5541 | Fax: 717-944-1430 | www.alsglobal.com
Associated Site: 20 Riverside Drive | Spring City, PA 19475 | Phone: 610-948-4903 | Fax: 717-944-1430 |

NELAP Certifications: NJ PA010 , NY 11759 , PA 22-293 DoD ELAP: PJLA 74618
State Certifications: FL E871113 , WA C999 , MD 128 , VA 460157 , WV DW 9961-C , WV 343, NJ PA101

Analytical Results Report For **Batta Environmental**

Project 1103624H-1067839
Workorder 3356287
Report ID 318829 on 4/29/2024

Certificate of Analysis

Enclosed are the analytical results for samples received by the laboratory on Apr 23, 2024.

The ALS Environmental laboratory in Middletown, Pennsylvania is a National Environmental Laboratory Accreditation Program (NELAP) accredited laboratory and as such, certifies that all applicable test results meet the requirements of NELAP.

If you have any questions regarding this certificate of analysis, please contact Sarah Leung (Project Coordinator) at (717) 944-5541.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program and any applicable state requirements. The test results meet requirements of the current NELAP standards or state requirements, where applicable. For a specific list of accredited analytes, refer to the certifications section of the ALS website at www.alsglobal.com/en/Our-Services/Life-Sciences/Environmental/Downloads.

ALS Middletown: 301 Fulling Mill Road, Middletown, PA 17057 : 717-944-5541.

Recipient(s):
Jason Shatney - Batta Environmental

This page is included as part of the Analytical Report and must be retained as a permanent record thereof.

Sarah Leung

Sarah Leung *(ALS Digital Signature)*
Project Coordinator

Sample Summary

Lab ID	Sample ID	Matrix	Date Collected	Date Received	Collector	Collection Company
3356287001	Sidewalk Caulk	Oil/Other	04/15/2024 00:00	04/23/2024 09:23	CBC	Collected By Client
3356287002	Concrete Expansion Joint	Oil/Other	04/15/2024 00:00	04/23/2024 09:23	CBC	Collected By Client
3356287003	Ext. Window Caulk	Oil/Other	04/15/2024 00:00	04/23/2024 09:23	CBC	Collected By Client
3356287004	Ext. Window Caulk	Oil/Other	04/15/2024 00:00	04/23/2024 09:23	CBC	Collected By Client
3356287005	Ext. Window Caulk	Oil/Other	04/15/2024 00:00	04/23/2024 09:23	CBC	Collected By Client
3356287006	Men's Locker Room Caulk	Oil/Other	04/15/2024 00:00	04/23/2024 09:23	CBC	Collected By Client
3356287007	Men's Locker Room Caulk	Oil/Other	04/15/2024 00:00	04/23/2024 09:23	CBC	Collected By Client
3356287008	Washer Room Caulk	Oil/Other	04/15/2024 00:00	04/23/2024 09:23	CBC	Collected By Client
3356287009	Washer Room Caulk	Oil/Other	04/15/2024 00:00	04/23/2024 09:23	CBC	Collected By Client

Reference

Notes

- Samples collected by ALS personnel are done so in accordance with the procedures set forth in the ALS Field Sampling Plan (20 - Field Services Sampling Plan).
- Except as qualified, Clean Water Act sample analyses are consistent with methodology requirements in 40 CFR Part 136, including but not limited to the following EPA Method reference revisions:
  EPA 300.1 Rev. 1.0-1997
  EPA 300.0 Rev. 2.1-1993
  EPA 353.2 Rev. 2.0-1993
  EPA 410.4 Rev. 1.0-1993
  EPA 420.4 Rev. 1.0-1993
  EPA 365.1 Rev. 2.0-1993
  EPA 200.7 Rev. 4.4-1994
  EPA 200.8 Rev. 5.4-1994
  EPA 245.1 Rev. 3.0-1994
- Except as qualified, Safe Drinking Water Act sample analyses are consistent with methodology requirements in 40 CFR Part 141.
- The Chain of Custody document is included as part of this report.
- All Library Search analytes should be regarded as tentative identifications based on the presumptive evidence of the mass spectra. Concentrations reported are estimated values.
- Parameters identified as "analyze immediately" require analysis within 15 minutes of collection. Any "analyze immediately" parameters not listed under the header "Field Parameters" are preformed in the laboratory and are therefore analyzed out of hold time.
- Method references listed on this report beginning with the prefix "S" followed by a method number (such as S2310B-97) refer to methods from "Standard Methods for the Examination of Water and Wastewater".
- For microbiological analyses, the "Prepared" value is the date/time into the incubator and the "Analyzed" value is the date/time out the incubator.
- An Analysis-Prep Method Cross Reference Table is included after Analytical Results & Qualifiers section in this report.
- Unless otherwise noted, all quantitative results for soils are reported on a dry weight basis.

Standard Acronyms/Flags

J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND) above the MDL
N	Indicates presumptive evidence of the presence of a compound
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
RDL	Practical Quantitation Limit for this Project
ND	Not Detected - indicates that the analyte was Not Detected
Cntr	Analysis was performed using this container
RegLmt	Regulatory Limit
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
DUP	Sample Duplicate
%Rec	Percent Recovery
RPD	Relative Percent Difference
LOD	DoD Limit of Detection
LOQ	DoD Limit of Quantitation
DL	DoD Detection Limit
I	Indicates reported value is greater than or equal to the Method Detection Limit (MDL) but less than the Report Detection Limit (RDL)
(S)	Surrogate Compound
NC	Not Calculated
*	Result outside of QC limits
#	Please reference the result in the Results Section for analyte-level flags.

Project Notations

P1	Project was received at a temperature greater than six degrees Celsius.
P2	Project was received without the presence of ice.

Sample Notations

Lab ID	Sample ID

Result Notations

Notation Ref.

Detected Results Summary

Not applicable for this WO.

Results

Client Sample ID	Sidewalk Caulk	Collected	04/15/2024 00:00
Lab Sample ID	3356287001	Lab Receipt	04/23/2024 09:23

PCBs

Compound	Result	Flag	Units	RDL	Method	Dilution	Analysis Date/Time	By	Cntr
Aroclor-1016	ND	ND,P1,P2	mg/kg	0.33	SW846 8082A	1	04/26/2024 11:09	KJH	A
Aroclor-1221	ND	ND,P1,P2	mg/kg	0.33	SW846 8082A	1	04/26/2024 11:09	KJH	A
Aroclor-1232	ND	ND,P1,P2	mg/kg	0.33	SW846 8082A	1	04/26/2024 11:09	KJH	A
Aroclor-1242	ND	ND,P1,P2	mg/kg	0.33	SW846 8082A	1	04/26/2024 11:09	KJH	A
Aroclor-1248	ND	ND,P1,P2	mg/kg	0.33	SW846 8082A	1	04/26/2024 11:09	KJH	A
Aroclor-1254	ND	ND,P1,P2	mg/kg	0.33	SW846 8082A	1	04/26/2024 11:09	KJH	A
Aroclor-1260	ND	ND,P1,P2	mg/kg	0.33	SW846 8082A	1	04/26/2024 11:09	KJH	A
Total Polychlorinated Biphenyl	ND	ND,P1,P2	mg/kg	0.33	SW846 8082A	1	04/26/2024 11:09	KJH	A

SURROGATES

Compound	CAS No	Recovery	Limits(%)	Analysis Date/Time	Qualifiers
Decachlorobiphenyl	2051-24-3	54.1%	49 – 115	04/26/2024 11:09	
Tetrachloro-m-xylene	877-09-8	79%	27 – 137	04/26/2024 11:09	

Results

Client Sample ID	Concrete Expansion Joint	Collected	04/15/2024 00:00
Lab Sample ID	3356287002	Lab Receipt	04/23/2024 09:23

PCBs

Compound	Result	Flag	Units	RDL	Method	Dilution	Analysis Date/Time	By	Cntr
Aroclor-1016	ND	ND,P1,P2	mg/kg	0.31	SW846 8082A	1	04/26/2024 11:19	KJH	A
Aroclor-1221	ND	ND,P1,P2	mg/kg	0.31	SW846 8082A	1	04/26/2024 11:19	KJH	A
Aroclor-1232	ND	ND,P1,P2	mg/kg	0.31	SW846 8082A	1	04/26/2024 11:19	KJH	A
Aroclor-1242	ND	ND,P1,P2	mg/kg	0.31	SW846 8082A	1	04/26/2024 11:19	KJH	A
Aroclor-1248	ND	ND,P1,P2	mg/kg	0.31	SW846 8082A	1	04/26/2024 11:19	KJH	A
Aroclor-1254	ND	ND,P1,P2	mg/kg	0.31	SW846 8082A	1	04/26/2024 11:19	KJH	A
Aroclor-1260	ND	ND,P1,P2	mg/kg	0.31	SW846 8082A	1	04/26/2024 11:19	KJH	A
Total Polychlorinated Biphenyl	ND	ND,P1,P2	mg/kg	0.31	SW846 8082A	1	04/26/2024 11:19	KJH	A

SURROGATES

Compound	CAS No	Recovery	Limits(%)	Analysis Date/Time	Qualifiers
Decachlorobiphenyl	2051-24-3	50.7%	49 – 115	04/26/2024 11:19	
Tetrachloro-m-xylene	877-09-8	71.8%	27 – 137	04/26/2024 11:19	

Results

Client Sample ID	Ext. Window Caulk	Collected	04/15/2024 00:00
Lab Sample ID	3356287003	Lab Receipt	04/23/2024 09:23

PCBs

Compound	Result	Flag	Units	RDL	Method	Dilution	Analysis Date/Time	By	Cntr
Aroclor-1016	ND	ND,P1,P2	mg/kg	0.62	SW846 8082A	1	04/26/2024 11:30	KJH	A
Aroclor-1221	ND	ND,P1,P2	mg/kg	0.62	SW846 8082A	1	04/26/2024 11:30	KJH	A
Aroclor-1232	ND	ND,P1,P2	mg/kg	0.62	SW846 8082A	1	04/26/2024 11:30	KJH	A
Aroclor-1242	ND	ND,P1,P2	mg/kg	0.62	SW846 8082A	1	04/26/2024 11:30	KJH	A
Aroclor-1248	ND	ND,P1,P2	mg/kg	0.62	SW846 8082A	1	04/26/2024 11:30	KJH	A
Aroclor-1254	ND	ND,P1,P2	mg/kg	0.62	SW846 8082A	1	04/26/2024 11:30	KJH	A
Aroclor-1260	ND	ND,P1,P2	mg/kg	0.62	SW846 8082A	1	04/26/2024 11:30	KJH	A
Total Polychlorinated Biphenyl	ND	ND,P1,P2	mg/kg	0.62	SW846 8082A	1	04/26/2024 11:30	KJH	A

SURROGATES

Compound	CAS No	Recovery	Limits(%)	Analysis Date/Time	Qualifiers
Decachlorobiphenyl	2051-24-3	53.3%	49 – 115	04/26/2024 11:30	
Tetrachloro-m-xylene	877-09-8	77.5%	27 – 137	04/26/2024 11:30	

Results

Client Sample ID	Ext. Window Caulk	Collected	04/15/2024 00:00
Lab Sample ID	3356287004	Lab Receipt	04/23/2024 09:23

PCBs

Compound	Result	Flag	Units	RDL	Method	Dilution	Analysis Date/Time	By	Cntr
Aroclor-1016	ND	ND,P1,P2	mg/kg	0.71	SW846 8082A	1	04/26/2024 11:41	KJH	A
Aroclor-1221	ND	ND,P1,P2	mg/kg	0.71	SW846 8082A	1	04/26/2024 11:41	KJH	A
Aroclor-1232	ND	ND,P1,P2	mg/kg	0.71	SW846 8082A	1	04/26/2024 11:41	KJH	A
Aroclor-1242	ND	ND,P1,P2	mg/kg	0.71	SW846 8082A	1	04/26/2024 11:41	KJH	A
Aroclor-1248	ND	ND,P1,P2	mg/kg	0.71	SW846 8082A	1	04/26/2024 11:41	KJH	A
Aroclor-1254	ND	ND,P1,P2	mg/kg	0.71	SW846 8082A	1	04/26/2024 11:41	KJH	A
Aroclor-1260	ND	ND,P1,P2	mg/kg	0.71	SW846 8082A	1	04/26/2024 11:41	KJH	A
Total Polychlorinated Biphenyl	ND	ND,P1,P2	mg/kg	0.71	SW846 8082A	1	04/26/2024 11:41	KJH	A

SURROGATES

Compound	CAS No	Recovery	Limits(%)	Analysis Date/Time	Qualifiers
Decachlorobiphenyl	2051-24-3	51.4%	49 – 115	04/26/2024 11:41	
Tetrachloro-m-xylene	877-09-8	77.2%	27 – 137	04/26/2024 11:41	

Results

Client Sample ID	Ext. Window Caulk	Collected	04/15/2024 00:00
Lab Sample ID	3356287005	Lab Receipt	04/23/2024 09:23

PCBs

Compound	Result	Flag	Units	RDL	Method	Dilution	Analysis Date/Time	By	Cntr
Aroclor-1016	ND	ND,P1,P2	mg/kg	0.28	SW846 8082A	1	04/26/2024 11:51	KJH	A
Aroclor-1221	ND	ND,P1,P2	mg/kg	0.28	SW846 8082A	1	04/26/2024 11:51	KJH	A
Aroclor-1232	ND	ND,P1,P2	mg/kg	0.28	SW846 8082A	1	04/26/2024 11:51	KJH	A
Aroclor-1242	ND	ND,P1,P2	mg/kg	0.28	SW846 8082A	1	04/26/2024 11:51	KJH	A
Aroclor-1248	ND	ND,P1,P2	mg/kg	0.28	SW846 8082A	1	04/26/2024 11:51	KJH	A
Aroclor-1254	ND	ND,P1,P2	mg/kg	0.28	SW846 8082A	1	04/26/2024 11:51	KJH	A
Aroclor-1260	ND	ND,P1,P2	mg/kg	0.28	SW846 8082A	1	04/26/2024 11:51	KJH	A
Total Polychlorinated Biphenyl	ND	ND,P1,P2	mg/kg	0.28	SW846 8082A	1	04/26/2024 11:51	KJH	A

SURROGATES

Compound	CAS No	Recovery	Limits(%)	Analysis Date/Time	Qualifiers
Decachlorobiphenyl	2051-24-3	57.8%	49 – 115	04/26/2024 11:51	
Tetrachloro-m-xylene	877-09-8	74.2%	27 – 137	04/26/2024 11:51	

Results

Client Sample ID	Men's Locker Room Caulk	Collected	04/15/2024 00:00
Lab Sample ID	3356287006	Lab Receipt	04/23/2024 09:23

PCBs

Compound	Result	Flag	Units	RDL	Method	Dilution	Analysis Date/Time	By	Cntr
Aroclor-1016	ND	ND,P1,P2	mg/kg	5.0	SW846 8082A	1	04/26/2024 12:02	KJH	A
Aroclor-1221	ND	ND,P1,P2	mg/kg	5.0	SW846 8082A	1	04/26/2024 12:02	KJH	A
Aroclor-1232	ND	ND,P1,P2	mg/kg	5.0	SW846 8082A	1	04/26/2024 12:02	KJH	A
Aroclor-1242	ND	ND,P1,P2	mg/kg	5.0	SW846 8082A	1	04/26/2024 12:02	KJH	A
Aroclor-1248	ND	ND,P1,P2	mg/kg	5.0	SW846 8082A	1	04/26/2024 12:02	KJH	A
Aroclor-1254	ND	ND,P1,P2	mg/kg	5.0	SW846 8082A	1	04/26/2024 12:02	KJH	A
Aroclor-1260	ND	ND,P1,P2	mg/kg	5.0	SW846 8082A	1	04/26/2024 12:02	KJH	A
Total Polychlorinated Biphenyl	ND	ND,P1,P2	mg/kg	5.0	SW846 8082A	1	04/26/2024 12:02	KJH	A

SURROGATES

Compound	CAS No	Recovery	Limits(%)	Analysis Date/Time	Qualifiers
Decachlorobiphenyl	2051-24-3	63.7%	49 – 115	04/26/2024 12:02	
Tetrachloro-m-xylene	877-09-8	84.1%	27 – 137	04/26/2024 12:02	

Results

Client Sample ID	Men's Locker Room Caulk	Collected	04/15/2024 00:00
Lab Sample ID	3356287007	Lab Receipt	04/23/2024 09:23

PCBs

Compound	Result	Flag	Units	RDL	Method	Dilution	Analysis Date/Time	By	Cntr
Aroclor-1016	ND	ND,P1,P2	mg/kg	1.2	SW846 8082A	1	04/26/2024 12:13	KJH	A
Aroclor-1221	ND	ND,P1,P2	mg/kg	1.2	SW846 8082A	1	04/26/2024 12:13	KJH	A
Aroclor-1232	ND	ND,P1,P2	mg/kg	1.2	SW846 8082A	1	04/26/2024 12:13	KJH	A
Aroclor-1242	ND	ND,P1,P2	mg/kg	1.2	SW846 8082A	1	04/26/2024 12:13	KJH	A
Aroclor-1248	ND	ND,P1,P2	mg/kg	1.2	SW846 8082A	1	04/26/2024 12:13	KJH	A
Aroclor-1254	ND	ND,P1,P2	mg/kg	1.2	SW846 8082A	1	04/26/2024 12:13	KJH	A
Aroclor-1260	ND	ND,P1,P2	mg/kg	1.2	SW846 8082A	1	04/26/2024 12:13	KJH	A
Total Polychlorinated Biphenyl	ND	ND,P1,P2	mg/kg	1.2	SW846 8082A	1	04/26/2024 12:13	KJH	A

SURROGATES

Compound	CAS No	Recovery	Limits(%)	Analysis Date/Time	Qualifiers
Decachlorobiphenyl	2051-24-3	53.4%	49 – 115	04/26/2024 12:13	
Tetrachloro-m-xylene	877-09-8	76.2%	27 – 137	04/26/2024 12:13	

Results

Client Sample ID	Washer Room Caulk	Collected	04/15/2024 00:00
Lab Sample ID	3356287008	Lab Receipt	04/23/2024 09:23

PCBs

Compound	Result	Flag	Units	RDL	Method	Dilution	Analysis Date/Time	By	Cntr
Aroclor-1016	ND	ND,P1,P2	mg/kg	0.41	SW846 8082A	1	04/26/2024 12:24	KJH	A
Aroclor-1221	ND	ND,P1,P2	mg/kg	0.41	SW846 8082A	1	04/26/2024 12:24	KJH	A
Aroclor-1232	ND	ND,P1,P2	mg/kg	0.41	SW846 8082A	1	04/26/2024 12:24	KJH	A
Aroclor-1242	ND	ND,P1,P2	mg/kg	0.41	SW846 8082A	1	04/26/2024 12:24	KJH	A
Aroclor-1248	ND	ND,P1,P2	mg/kg	0.41	SW846 8082A	1	04/26/2024 12:24	KJH	A
Aroclor-1254	ND	ND,P1,P2	mg/kg	0.41	SW846 8082A	1	04/26/2024 12:24	KJH	A
Aroclor-1260	ND	ND,P1,P2	mg/kg	0.41	SW846 8082A	1	04/26/2024 12:24	KJH	A
Total Polychlorinated Biphenyl	ND	ND,P1,P2	mg/kg	0.41	SW846 8082A	1	04/26/2024 12:24	KJH	A

SURROGATES

Compound	CAS No	Recovery	Limits(%)	Analysis Date/Time	Qualifiers
Decachlorobiphenyl	2051-24-3	54.1%	49 – 115	04/26/2024 12:24	
Tetrachloro-m-xylene	877-09-8	72.5%	27 – 137	04/26/2024 12:24	

Results

Client Sample ID	Washer Room Caulk	Collected	04/15/2024 00:00
Lab Sample ID	3356287009	Lab Receipt	04/23/2024 09:23

PCBs

Compound	Result	Flag	Units	RDL	Method	Dilution	Analysis Date/Time	By	Cntr
Aroclor-1016	ND	ND,P1,P2	mg/kg	0.99	SW846 8082A	1	04/26/2024 12:34	KJH	A
Aroclor-1221	ND	ND,P1,P2	mg/kg	0.99	SW846 8082A	1	04/26/2024 12:34	KJH	A
Aroclor-1232	ND	ND,P1,P2	mg/kg	0.99	SW846 8082A	1	04/26/2024 12:34	KJH	A
Aroclor-1242	ND	ND,P1,P2	mg/kg	0.99	SW846 8082A	1	04/26/2024 12:34	KJH	A
Aroclor-1248	ND	ND,P1,P2	mg/kg	0.99	SW846 8082A	1	04/26/2024 12:34	KJH	A
Aroclor-1254	ND	ND,P1,P2	mg/kg	0.99	SW846 8082A	1	04/26/2024 12:34	KJH	A
Aroclor-1260	ND	ND,P1,P2	mg/kg	0.99	SW846 8082A	1	04/26/2024 12:34	KJH	A
Total Polychlorinated Biphenyl	ND	ND,P1,P2	mg/kg	0.99	SW846 8082A	1	04/26/2024 12:34	KJH	A

SURROGATES

Compound	CAS No	Recovery	Limits(%)	Analysis Date/Time	Qualifiers
Decachlorobiphenyl	2051-24-3	65.8%	49 – 115	04/26/2024 12:34	
Tetrachloro-m-xylene	877-09-8	85.1%	27 – 137	04/26/2024 12:34	

Sample - Method Cross Reference Table

Lab ID	Sample ID	Analysis Method	Preparation Method	Leachate Method
3356287001	Sidewalk Caulk	SW846 8082A	SW846 3546	
3356287002	Concrete Expansion Joint	SW846 8082A	SW846 3546	
3356287003	Ext. Window Caulk	SW846 8082A	SW846 3546	
3356287004	Ext. Window Caulk	SW846 8082A	SW846 3546	
3356287005	Ext. Window Caulk	SW846 8082A	SW846 3546	
3356287006	Men's Locker Room Caulk	SW846 8082A	SW846 3546	
3356287007	Men's Locker Room Caulk	SW846 8082A	SW846 3546	
3356287008	Washer Room Caulk	SW846 8082A	SW846 3546	
3356287009	Washer Room Caulk	SW846 8082A	SW846 3546	

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Lab ID	Sample ID	Preparation Method	Prep Batch	Prep Date/Time	By	Analysis Method	Anly Batch
3356287001	Sidewalk Caulk	SW846 3546	1188613	04/25/2024 13:40	SRL	SW846 8082A	1190630
3356287002	Concrete Expansion Joint	SW846 3546	1188613	04/25/2024 13:40	SRL	SW846 8082A	1190630
3356287003	Ext. Window Caulk	SW846 3546	1188613	04/25/2024 13:40	SRL	SW846 8082A	1190630
3356287004	Ext. Window Caulk	SW846 3546	1188613	04/25/2024 13:40	SRL	SW846 8082A	1190630
3356287005	Ext. Window Caulk	SW846 3546	1188613	04/25/2024 13:40	SRL	SW846 8082A	1190630
3356287006	Men's Locker Room Caulk	SW846 3546	1188613	04/25/2024 13:40	SRL	SW846 8082A	1190630
3356287007	Men's Locker Room Caulk	SW846 3546	1188613	04/25/2024 13:40	SRL	SW846 8082A	1190630
3356287008	Washer Room Caulk	SW846 3546	1188613	04/25/2024 13:40	SRL	SW846 8082A	1190630
3356287009	Washer Room Caulk	SW846 3546	1188613	04/25/2024 13:40	SRL	SW846 8082A	1190630

301 Fulling Mill Rd
Middletown, PA 17057
P. 717-944-5541
F.717-944-1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

3356287
Logged By: MJE
PM: SSL

1 of 1

Client Name: BATTA Laboratories, LLC
Address: Delaware Industrial Park - 6 Garfield Way, Newark, DE 19713-5817
Contact: jasons@battaenv.com; angelalewis@battaenv.com
Phone#: 302-737-3376 x122
Project Name/#: 1103624H - 1067839
Bill To:

TAT: [X] Normal-Standard TAT is 10-12 business days. [ ] Rush-Subject to ALS approval and surcharges.
Date Required: Approved?
Email? [x]-Y jasons@battaenv.com; angelalewis@battaenv.com
Fax? [ ]-Y No.:

Container Type: CG | Container Size: | Preservative: None

ANALYSES/METHOD REQUESTED: PCB (SW846 8082A)

W.O. Temp: ____ Therm ID: ____
Courier/Tracking #:
Purchase Order #:
Project Comments:

ALS Field Services: ☐ Pickup ☐ Labor ☐ Composite Sampling ☐ Rental Equipment
Other:

#	Sample Description/Location (as it will appear on the lab report)	Date Collected mm/dd/yy	Time hh:mm	*G or C	**Matrix	PCB (SW846 8082A) Enter Number of Containers	Sample/COC Comments
1	Sidewalk Caulk	4/15/24	n/a	G	Bulk	1	
2	Concrete Expansion Joint	4/15/24	n/a	G	Bulk	1	
3	Ext. Window Caulk	4/15/24	n/a	G	Bulk	1	
4	Ext. Window Caulk	4/15/24	n/a	G	Bulk	1	
5	Ext. Window Caulk	4/15/24	n/a	G	Bulk	1	
6	Men's Locker Room Caulk	4/15/24	n/a	G	Bulk	1	
7	Men's Locker Room Caulk	4/15/24	n/a	G	Bulk	1	
8	Washer Room Caulk	4/15/24	n/a	G	Bulk	1	
9	Washer Room Caulk	4/15/24	n/a	G	Bulk	1	
10							

Temp By: LDC | WO Temp (°C): 19°c | Therm ID: 571
Receipt Info Completed By: LDC
Cooler Custody Seal Intact Y N
Sample Custody Seal Intact Y N
Received on Ice Y N NA
Cooler & Samples Intact Y N
Correct Containers Provided Y N
Sample Label/COC Agree Y N
Adequate Sample Volumes Y N
CR6 Samples Filtered Y N NA
OP Samples Filtered Y N NA
VOA Trip Blank Y N NA
NJ≤4 Days? Y N
Rad Screen (uCi) —
Courier/Tracking #: 12242 F6V02 2557 4208
SDWA Compliance Y N
PWSID —
WV Containers 0-6°C Y N NA
No sampler Bag/WP Matrix:O
LDC 4/28/24
pm notified. 4/28/24

SAMPLED BY (Please Print): Client
Sampler Comments:

#	Relinquished By / Company Name	Date	Time	#	Received By / Company Name	Date	Time
1	JEF / Batta	4/16/24	1500	2	Fedex UPS		
3	UPS	4/29/24	9:23	4	[illegible] /ALS	4/29/24	9:23
5				6			
7				8			
9				10			

Data Deliverables: [x] Standard [ ] CLP-like [ ] USACE/DOD [ ]
Reportable to PADEP? Yes [ ] No [x]
PWSID #
EDDS: Format Type-
Special Processing: USACE [ ] Navy [ ]
Sample Disposal: Lab [x] Special [ ]
State Samples Collected In: [ ] NY [ ] NJ [ ] PA [ ] NC [x] MD other

* G=Grab; C=Composite **Matrix - Al=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

ALS SHIPPING ADDRESS: 301 Fulling Mill Road, MIDDLETOWN, PA 17057

Rev 11/18

batta LABORATORIES
6 Garfield Way, Newark, DE 19713-5817
Tel: (302) 737-3376 Fax: (302) 737-5764
Page ___ of ___

Email: battaenv@battaenv.com
Web: www.battaenv.com

Chain of Custody for Mold Analysis

AIHA LAP, LLC# 100448
NY ELAP#11993
EPA Lab #DE004
MD Lab ID #263
NVLAP #101032

BLI Project #: L363624

Customer Billing Information:	Shipping Information	Turnaround Times (check one, refer to notes*)	Method of Payment
Name:	☐ Picked up by BATTA	☐ 3 Hours/ Immediate (Note 1)	☐ Cash Cashier:
Billing Address 1:	☐ Delivered by customer	☐ 6 Hours/ Same Day (Note 2)	☐ Visa/MasterCard/Discover
Billing Address 2:	☐ Shipped by customer	☐ 24 Hours (Note 3)	☐ Money Order
Tel 1:		☐ 48 Hours (Note 4)	☐ Purchase Order #
Email:		☒ 72 Hours (Note 5)	☐ Check #
Results To:		☐ 5 Days (Note 6)	☐ Other
			☐ Unit Price/Quote
			☐ Total Payment
			☐ Reference #

***Notes Regarding Turnaround Times (TATs)**

1 Specific TATs depend on the test requested. TATs may not be available for all types of analysis. Client must make arrangements with lab to guarantee TAT. Premium rate will apply.
2 Same Day (by 5 p.m.) offered if samples received by 12 noon. After that time, a 6-hour designation may be offered. A 6-hour/Same day TAT may not be available with all analyses.
3 Unless a specific time is requested, results are guaranteed by 5 p.m. on the following business day. The turnaround time of 24 hours may not be available with all analysis.
4 Unless a specific time is requested, results are guaranteed by 5p.m. on the 2nd business day.
5 Unless a specific time is requested, results are guaranteed by 5 p.m. on the 3rd business day.
6 Unless a specific time is requested, results are guaranteed by 5 p.m. on the 5th business day.

105

Project Information

Project Name:	Project Location:	Project #:	Sampled By:
Fullarton Fire Station #8	4401 Fitch Ave Nottingham, MD 21236	BEA# 1103624 H	Justin Soliz

Sample Information

BL Use Only	Field Sample ID#	Sample Location & Description	Sampling Date/Time	Sampling Volume/Area	Sample Type (X)					Comments
					SWAB	BULK	SPORE TRAP	TAPE	Other	
061848	B343-7047	Kitchen HVAC - 1	4/15/2024					X		
849	B343-7032	Kitchen HVAC - 2	4/15/2024					X		

Sample Relinquished By:	Date: 4/18/24	Time: 1:20pm
Sample Received By:	Date:	Time:

Laboratory Use Only

Logged-in By	Log-in Date	Date	Field Samples Acceptable ☐ Yes ☐ No
			Sample Condition

Note to Client: Batta Laboratories recommends that blanks be supplied by the client when mandated by published methods

BLI Project #	L363624
Client & Project Name	1103624H Fullerton Fire Station #8
Project Location	4401 Fifth Ave Nottingham, MD 021236
Date Sampled/ By	4/15/2024 Justin Soliz

Place "X" in column corresponding to fungal estimate. Rare: 1-10 spores, Low = 11-100 spores, Medium: 101-1000 spores, or High: >1001 spores. If None Detected, Not Analyzed, or Overloaded choose item from pull-down menu in peach cell.

Lab Sample ID	1067848				1067849															
Client Sample ID	B-343-7047				B343-7032															
Sampling Location	Kitchen HVAC - 1				Kitchen HVAC - 2															
Sample Type (choose or type)	Tape				Tape															
	Rare	Low	Medium	High	Rare	Low	Medium	High	Rare	Low	Medium	High	Rare	Low	Medium	High	Rare	Low	Medium	High
Spores																				
Alternaria	X				X															
Ascospores																				
Aspergillus/ Penicillium				X																
Basidiospores																				
Bipolaris/ Drechslera																				
Cercospora																				
Chaetomium								X												
Cladosporium				X																
Curvularia																				
Epicoccum	X																			
Fusarium																				
Ganoderma																				
Helicomyces																				
Nigrospora																				
Oidium																				
Pithomyces/ Ulocladium					X															
Polythrincium																				
Rusts/ Smuts/ Myxomycetes																				
Spegazzinia																				
Stachybotrys																				
Stemphylium																				
Tetraploa																				
Torula																				
Unidentified																				
Sample Status																				
Other Materials																				
Pollen		X						X												
Hyphal fragments																				
Insect fragments	X																			
Density Ratings																				
Skin cell fragments	2				2															
Debris/ fib/ bkgd particulate	2				2															
	1067848				1067849															
Analyst's Comments:																				

Analyst: Madell Collins

Date: 4/22/2024

Dedicated to a Cleaner Environment Since 1982

NY ELAP Lab# 11993 PCM, PLM, TEM & Lead

BATTA LABORATORIES, LLC
A Certified MBE Company
Delaware Industrial Park - 6 Garfield Way - Newark, DE 19713-5817
(302) 737-3376 - Fax (302) 737-5764
Web: www.battaenv.com E-mail: battaenv@battaenv.com

EPA Lab ID #DE004

NVLAP Lab Code: 101032-0

CERTIFICATE OF MOLD DIRECT EXAM ANALYSIS

Batch #: L363624 - 04/15/24 - 2
Rev#: 1

Test Method: Batta SoP EM-13 & ASTM D7658-17

Report Date: 4/24/2024

Sampling Data Description of Revision: 1067848: Additional spores found during QC reanalysis

Date Sampled: 4/15/2024

BLI Project #: L363624

Sampled By: Justin Soliz

Project Name: 1103624H Fullerton Fire Station #8

Date Analyzed: 4/23/2024

Project Location: 4401 Fitch Ave Nottingham, MD 21236

Sample Range, This Page: 1067848 - 1067849

Lab Sample ID	1067848				1067849															
Client Sample ID	B-343-7047				B343-7032				no sample				no sample				no sample			
Location	Kitchen HVAC - 1				Kitchen HVAC - 2															
Sample Type	Tape				Tape															
Spores	Rare	Low	Medium	High	Rare	Low	Medium	High	Rare	Low	Medium	High	Rare	Low	Medium	High	Rare	Low	Medium	High
Alternaria	X				X															
Ascospores																				
Aspergillus/ Penicillium				X																
Basidiospores																				
Bipolaris/ Drechslera																				
Cercospora																				
Chaetomium																				
Cladosporium				X				X												
Curvularia																				
Epicoccum	X																			
Fusarium																				
Ganoderma																				
Helicomyces																				
Nigrospora																				
Oidium																				
Pithomyces/ Ulocladium					X															
Polythrincium																				
Rusts/ Smuts/ Myxomycetes																				
Spegazzinia	X																			
Stachybotrys	X																			
Stemphylium																				
Tetraploa																				
Torula																				
Unidentified																				
Other Materials																				
Pollen																				
Hyphal fragments		X						X												
Insect fragments		X																		
Density Ratings																				
Skin cell fragments (0-5)	2				2															
Debris/ fibers/ background particulate (0-5)	2				2															

Batch ID# convention is: BATTA Project Number - Sampling Date - Number of Samples in Batch

Analyst: Madell Collins Reviewed By: ARL

Rare: 1-10 spores present, Low = 11-100 spores present, Medium: 101-1000 spores present, or High: >1001 spores present. ND = None Detected. NA = Not Analyzed. OL = Overloaded. Density rankings of 4 or 5 may inhibit accurate detection. Samples received in acceptable condition except where noted. Batta Laboratories, LLC is not responsible for sample collection, nor interpretations made by others. Results relate only to the items tested. This report does not constitute endorsement by AIHA LAP, LLC. and/or any other U.S. governmental agencies and may not be certified by all local, state and federal regulatory agencies. Batta thrives on customer feedback to improve the quality of our services. Please e-mail your feedback to feedback@battaenv.com. This report must not be reproduced without the written approval of Batta Laboratories, LLC.

End of report

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Asbestos Accreditation

Sharon Thompson
Name

Signature

IMP Review
Course Title

240000883

Exam Date: 04/19/2024
Course Date: 02/15/2024
Exp Date: 02/15/2025

STATE OF MARYLAND

Aerosol Monitoring & Analysis, Inc.
Training Provider

1331 Ashton Road
Address

Hanover, MD 21076
City, State, Zip

410-684-3327
Phone

Lorraine Anderson
Name of Training Director
For additional information, call MDE (410) 537-3200

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 101032-0

110

Batta Laboratories, LLC

Newark, DE

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Asbestos Fiber Analysis

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2023-07-01 through 2024-06-30

Effective Dates

DEPARTMENT OF COMMERCE * UNITED STATES OF AMERICA *

For the National Voluntary Laboratory Accreditation Program

SECTION 01 1000 - SUMMARY

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. Project information.
2. Work covered by Contract Documents.
3. Work performed by Owner.
4. Owner-furnished/Contractor-installed (OFCI) products.
5. Owner-furnished/Owner-installed (OFOI) products.
6. Contractor-furnished/Owner-installed (CFOI) products.
7. Contractor's use of site and premises.
8. Coordination with occupants.
9. Work restrictions.
10. Specification and Drawing conventions.
11. Miscellaneous provisions.

B. Related Requirements:

1. Section 01 5000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 01 7300 "Execution" for coordination of Owner-installed products.

1.3 PROJECT INFORMATION

A. Project Identification: Fullerton Fire Station #8 - Renovation & Addition.

1. Project Location: 4401 Fitch Avenue, Nottingham, Maryland, 21236.

B. Owner: Baltimore County.

1. Owner's Representative: Steve Gallatin.

C. Architect: Manns Woodward Studios, Inc..

1. Architect's Representative: Evan Gray; egray@mwsarch.com; 410-344-1460.

D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. MEP Engineer: C.C. Johnson Malhotra, P.C.

a. Representative: Uday Patel
b. Address: 400 East Pratt Street, Suite 604, Baltimore, MD, 21202
c. Phone: 410-461-9920

2. Structural Engineer: Mincin Patel Milano Engineering

a. Representative: Dave Mincin
b. Address: 6511 Harford Road, Baltimore, Maryland, 21214
c. Phone: 410-254-7500

3. Civil Engineer: MK Engineering

a. Representative: Mark Camponeschi
b. Address: 3300 Clipper Mill Rd., Suite 201, Baltimore MD 21211
c. Phone: 667-210-2479

E. Project shall be subject to prevailing wage requirements as required by Baltimore County. Contractor shall comply with wage determination for the area in which the work is to be performed. Contractor shall be required to provide all required documentation to prove compliance with prevailing wage laws of the Authority Having Jurisdiction.

F. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. The Work generally consists of the expansion and renovation of the existing Baltimore County Fullerton Fire Station #8. The project generally incudes the renovation of approximately 2,660 square feet of bathroom, locker room, bunk room, support spaces and other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

C. Guarantee/Warranty

1. Each Contractor shall furnish a guarantee covering all labor and materials furnished by the Contractor for a period of two (2) years from the date of final acceptance of the Contractor's work, and the Contractor shall agree to repair and make good at their own expense any and all defects whichmay appear in his work during that time if, in the judgement of the Architect/Owner, such defects arise form defective workmanship and/or material.
2. The above shall not in any way void or abrogate manufacturer's warranty or guarantee. Certificates of guarantee/warranty shall be delivered to the Owner

1.5 PHASED CONSTRUCTION

A. Construct the Work in a single phase.

1.6 WORK PERFORMED BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.

1. The Owner shall be installing all Data/IT cable and equipment throughout the building. This includes but is not limited to, providing equipment and terminating cables at face plates and equipment. .

1.7 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site: Each Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Limits on Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy Project site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.9 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: Work during this time shall be evaluated on a case by case basis. Contractor shall be required to obtain written approval from the Owner prior to proceeding work in this time frame..
2. Early Morning Hours: Work during this time shall be evaluated on a case by case basis. Contractor shall be required to obtain written approval from the Owner prior to proceeding work in this time frame..

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

E. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

1.10 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. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. 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 numbers found in this Project Manual.

1.11 MISCELLANEOUS PROVISIONS

A. Prime Contractor(s) shall be responsible for ensuring all sub-contractors contracted to perform a portion of the Work have possession of ALL CONTRACT DOCUMENTS. Sub-contractors shall be responsible for reviewing all contract documents including but not limited to drawings and specifications and providing all items outlined withn the documents to be provided along with all connections, systems, supports, and miscellaneous items required for the items to function properly as intended.

B. Drawing Coordination: Generally, requirements for materials and products identified on Drawings are described in detail in the Specifications. However, items may be indicated either only on the drawings or only within the specifications. If items are indicated in one document only it shall be the responsibility of the Contractor to provide the item indicated along with all the components, connections, systems, supports or other miscellaneous items required for the proper operation and installation of the item identified within the single document.

C. References within the Drawings of Specifications to other Drawings of Specifications indicates the potential existence of additional information. If no additional information exists within the referenced drawing(s) or specification(s), the Contractor shall remain responsible for the installation of the Work indicated or graphically depicted. Where Work typically would be structural or load bearing in nature, the Contractor shall provide reinforcement, bracketing, bracing, or otherwise attach such Work as indicated within similar details existing within the Drawings or Specifications. It is also the Contractors responsibility to seek clarification for such items prior to submitting a bid to perform Work. If no clarification is requested prior to the submission of a bid, it shall be deemed that the Contractor understands the extent of Work both indicated and graphically depicted and has included such within the Contract Sum

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

SECTION 01 2500 - 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.

B. Related Requirements:

1. Section 01 2300 "Alternates" for products selected under an alternate.
2. Section 01 6000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

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

1. 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.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.
3. Compatibility: Compatibility shall be determined by the Architect and Owner at the time of the substitution request. Products shall not be considered compatible if the products require the Owner to purchase or maintain attic stock, maintenance stock or replacement parts of two different products that perform the same function.

1.4 ACTION SUBMITTALS

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

1. Substitution Request Form: Use CSI Form 13.1A.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Certificates and qualification data, where applicable or requested.
    g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
    j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
    k. Cost information, including a proposal of change, if any, in the Contract Sum.
    l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
    m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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

    a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.

b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 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.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

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

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. 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: Not allowed unless otherwise indicated.

C. 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

SUBSTITUTION REQUEST FORM

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section Number: _____

Page Number: _____ Article: _____

Proposed Substitution: _____

Manufacturer: _____ Website URL: _____

Trade Name: _____ Model No.: _____

Installer: _____ Phone: _____

Differences between proposed substitution and specified product: _____

☐ Point-by-point comparative data attached (Note: This is REQUIRED for consideration as a proposed Substitution)

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

Does proposed substitution affect other Work? ☐ No ☐ Yes (explain) _____

Cost Savings: [Deduct] _____ Dollars $ _____

Schedule Impact: [Add] [Deduct] _____ days.

THE UNDERSIGNED CERTIFIES:

- Proposed substitution has been fully investigated by the General Contractor, and determined to be equal or superior in all respects to specified product.
- General Contractor acknowledges that this proposed substitution must also meet the design intent expressed in the Contract Documents, as judged by the Architect and substantiated by the materials submitted herewith.
- General Contractor will furnish the same warranty for proposed substitution as for specified product.
- General Contractor has verified that the same level of maintenance service and similar availability of replacement parts, as applicable, is available.
- General Contractor has verified that the proposed substitution will have no adverse effect on other trades, and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent will be waived by the General Contractor.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made by the General Contractor for changes to building design, including A/E design, detailing, and construction costs caused by this substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be completed by the General Contractor in all respects.

Submitted By (Name): _____

Signature: _____

On Behalf of (Company): _____

Address: _____

Email: _____

Attachments: _____

_____

_____

ARCHITECT'S REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 3300.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 3300.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Architect: Manns Woodward Studios, Inc.

Reviewed By (Name): _____

Signature: _____

Date: _____

END OF SUBSTITUTION REQUEST FORM

SECTION 01 2600 - 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. Section 01 2500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work,not involving adjustments to the Contract Sum or the Contract Time, in form acceptable to the Architect and consistent with other communications between the Architect and the Contractor.

1.4 PROPOSAL REQUESTS

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

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within 14 consecutive days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
e. Quotation Form: Use forms acceptable to Architect.

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

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01 2500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.5 CHANGE ORDER PROCEDURES

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

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent review within a Change Order Proposal.

1. Construction Change Directive shall contain a complete description of change in the Work. It also designates the method to be followed to determine any change in the Contract Sum of the Contract Time where different than described below.

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 2600

SECTION 01 2900 - 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.

B. Related Requirements:

1. Section 01 2600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 01 3200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

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

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

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

2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

3. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.

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. Owner reserves the right to require line items of the schedule of values be broken down further as may be required to satisfy the Owner.

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

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

2. Arrange schedule of values consistent with format of AIA Document G703.
3. 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.

        1) Labor.
        2) Materials.
        3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. 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. If required, include evidence of insurance.

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

1.5 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.

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

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

C. Payment Application Times: Submit Application for Payment to Architect by the 5th 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 (pencil) copy of Application for Payment seven days prior to due date for review by Architect. Draft copy does need to be notarized.

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

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

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts 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.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

F. 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 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.
2. 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.

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

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

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

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

I. 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. Schedule of unit prices.
5. List of Contractor's staff assignments.
6. List of Contractor's principal consultants.
7. Initial progress report.
8. Certificates of insurance and insurance policies.
9. Performance and payment bonds.
10. Data needed to acquire Owner's insurance.

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

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

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

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2900

SECTION 01 3100 - 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. Requests for Information (RFIs).
4. Project Web site.
5. Project meetings.

B. Each contractor (General Contractor and Sub-contractor) shall participate in coordiantion requirements. The contract documents do not specify that certain areas of responsibility are assigned to a specific contractor, therfore it is the General Contractor's responsibility to include all sub-contractors within the coordination process.

C. Related Requirements:

1. Section 01 3200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 01 7300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01 7700 "Closeout Procedures" for coordinating closeout of the Contract.
4. Section 01 9113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

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

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

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 and telephone numbers, including home, office, and 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.

1.5 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.

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.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. 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.

1.6 COORDINATION DRAWINGS

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

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

a. 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. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
e. Indicate required installation sequences.
f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. 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 ceiling plenum to accommodate layout of light fixtures 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, switch board, 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 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 changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 3300 "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.

2. File Preparation Format: DWG,
3. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.

4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

1.7 REQUESTS FOR INFORMATION (RFIs)

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

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

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

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of Architect.
5. RFI number, numbered sequentially.
6. RFI subject.
7. Specification Section number and title and related paragraphs, as appropriate.
8. Drawing number and detail references, as appropriate.
9. Field dimensions and conditions, as appropriate.
10. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
11. Contractor's signature.
12. 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 Adobe Acrobat PDF format.

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

1. The following 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 of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 2600 "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.

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

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect and Construction Manager.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's and Construction Manager's response was received.

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

1. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

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

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.

2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Unless otherwise indicated, entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to all attendees and everyone concerned, within three days of the meeting.

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

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

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFIs.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. [LEED requirements] [Sustainable design requirements].
    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.

4. Minutes: The Architect shall be responsible for recording and distributing the meeting minutes.

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

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

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

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 60 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, 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 preparing operations and maintenance data.
    e. Requirements for delivery of material samples, attic stock, and spare parts.
    f. Requirements for demonstration and training.
    g. Preparation of Contractor's punch list.
    h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    i. Submittal procedures.
    j. Coordination of separate contracts.
    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: The Architect shall record and distribute the meeting minutes.

E. Progress Meetings: Conduct progress meetings at biweekly intervals.

F. Progress Meetings: Architect shall conduct the progress meetings at biweekly intervals. The Owner reserves the right to change the frequency of the progress meetings.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, the General Contractor's Superintendent and Project Manager shall be present at these meetings. Sub-contractors, suppliers, and other entities shall not be present at progress meetings unless specifically authorized by the Owner or Architect prior to the meeting.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

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

    1) Review schedule for next period.

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

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

4. Minutes: The Architect shall record and distribute the meeting minutes to each party present and to parties requiring information.
5. Schedule Updating: General Contractor shall revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. The Contractor shall issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

SECTION 01 3200 - 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. Site condition reports.
5. Special reports.

B. Related Requirements:

1. Section 01 3300 "Submittal Procedures" for submitting schedules and reports.
2. Section 01 4000 "Quality Requirements" for submitting a schedule of tests and inspections.

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 the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

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 when activities can be performed and the critical path of Project.

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 the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

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

1. PDF electronic file.

B. Startup construction schedule.

1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

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

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, 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 all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.

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

F. Daily Construction Reports: Submit at monthly intervals.

G. Material Location Reports: Submit at monthly intervals.

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

I. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "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 interim milestones and partial Owner occupancy.
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.
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, submittal schedule, progress reports, payment requests, and other required schedules and reports.

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

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

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

a. The Contractor shall be responsible for providing the required items, materials, procedures, and protections to complete the Work within the Time Frame set forth within the Contract Documents. This includes, but is not limited to, items required to work within the weather conditions reasonably expected within the Contract Time Frame.

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

1. Phasing: Arrange list of activities on schedule by phase.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 1000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 1000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Work Restrictions: Show the effect of the following items on the schedule:

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

6. 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.

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

a. Structural completion.
b. Temporary enclosure and space conditioning.
c. Permanent space enclosure.
d. Completion of mechanical installation.
e. Completion of electrical installation.
f. Substantial Completion.

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

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

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

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

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.

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

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 25 percent increments within time bar.

2.3 REPORTS

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

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

B. 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.

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: 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, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION - Not Used

END OF SECTION 01 3200

SECTION 01 3233 - PHOTOGRAPHIC 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 the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.

B. Related Requirements:

1. Section 01 3300 "Submittal Procedures" for submitting photographic documentation.
2. Section 01 7700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
3. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
4. Section 02 4119 "Selective Structure Demolition" for photographic documentation before selective demolition operations commence.

1.3 ALLOWANCES

1.4 INFORMATIONAL SUBMITTALS

A. Digital Photographs: Submit image files within 5 days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:

    a. Date photograph was taken.

1.5 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner and Architect for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

B. Digital Video Recordings: Provide high-resolution, digital video disc in format acceptable to Architect.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

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

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

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

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

1. Flag construction limits before taking construction photographs.
2. Take photographs to show existing conditions adjacent to property before starting the Work.
3. Take photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Architect -Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

END OF SECTION 01 3233

SECTION 01 3300 - 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 requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 01 2900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 3200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 01 7823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 01 7839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 01 7900 "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."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

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

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: 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. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. 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. Scheduled date for Architect's final release or approval.
    f. Scheduled dates for purchasing.
    g. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

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. All items requiring color selections will not be reviewed for color selection until all related items requiring color selection are submitted respectively. Furthermore, no colors shall be chosen until the Owner has selected a color scheme based upon the submitted samples of finishes. For example, no exterior colors shall be selected until all items exposed on the exterior requiring a color selection have been submitted, grouped and selected by the Owner.
5. Interior colors will not be selected until permanent lighting has been installed. The contractor may opt to temporarily install lighting that matches the permanently installed lighting within each area as selected by the Architect in the event that color selections may affect the construction schedule. Installation of temporary lighting will not be cause for the Contractor to pursue additional compensation.
6. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

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

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

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.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

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

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

a. File name shall use Specification Section number followed by a decimal point and then a sequential number followed by a brief description of submitted items (e.g., 072100.01 - Cavity Wall Insulation). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 072100.01.A - Cavity Wall Insulation).

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

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

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. 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.

H. 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.

I. 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.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Post electronic submittals as PDF electronic files in form and manner acceptable to Architect.

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

2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.

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

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable. Where more than one product type is indicated, Contractor shall indicate where each product is anticipated to be utilized within the Work.
3. Include the following information, as applicable:

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

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

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

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

a. PDF electronic file.

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

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

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

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

a. PDF electronic file.

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

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

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.
    e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    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.

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

    a. Number of Samples: Submit two full 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.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit two sets of Samples. Architect will retain <one> Sample sets; remainder will be returned.

        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.

E. 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.
5. Submit product schedule in the following format:

a. PDF electronic file.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 01 3100 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 01 3200 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 2900 "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 4000 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 7700 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 01 7823 "Operation and Maintenance Data."

L. 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.

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

N. 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.

O. 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.

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

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

R. 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.

S. 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.

T. 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:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

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

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

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

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

2.2 DELEGATED-DESIGN SERVICES

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

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

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

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 7700 "Closeout Procedures."

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

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will attach to each submittal a "SUBMITTAL REVIEW FORM AND TRANSMITTAL" marked appropriately indicating architect's action.

1. See attached "SUBMITTAL REVIEW FORM AND TRANSMITTAL" form for architect's actions, definitions, and information. The information and definitions provided within the attached form shall be enforceable and applicable as if listed within this specification.

B. 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.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

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

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01 3300

MANNS WOODWARD STUDIOS INC.

SUBMITTAL REVIEW FORM AND TRANSMITTAL

V21.3

Project:	Owner:

General/Prime Contractor:	Architect:	
	Manns Woodward Studios Inc. 10839 Philadelphia Road, Suite D White Marsh, Maryland 21162	Project Number:

SUBMITTAL

Name: **00 0000.001.001 Test Submittal Name**

Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work. The purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

ARCHITECTS ACTION

By:

Date:

The following indicated "ACTION" is the appropriate deemed "ACTION" for the above indicated "SUBMITTAL". The "ACTION" indicated below is based upon a review of the Contractors "SUBMITTAL" but is only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review of such "SUBMITTAL" is not conducted for the purpose of determining the accuracy and completeness of the other details such as dimensions and quantities, or for substantiating instructions for installation; All of which remains the responsibility of the Contractor. The Contractor shall not be relieved of responsibility for deviating from requirements of the Contract Documents by the Architects "Approval" of Shop Drawings. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar Submittals by the Architects "Approval" thereof.

☐ APPROVED:	Submittal conforms with information given and the design concept expressed in the Contract Documents
☐ APPROVED, COMMENTS NOTED:	Submittal conforms with information given and the design concept expressed in the Contract Documents EXCEPT AS NOTED. Contractor shall coordinate and/or adjust submittal information/Contractors work plan to conform to the information given and the design concept expressed in the Contract Documents. DO NOT RESUBMIT unless noted otherwise.
☐ REVISE AND RESUBMIT:	Submittal does not conform with information given and the design concept expressed in the Contract Documents. Contractor shall coordinate and/or adjust submittal information/Contractors work plan to conform to the information given and the design concept expressed in the Contract Documents. RESUBMIT.
☐ REJECTED	
☐ RETURNED WITHOUT ACTION	
☐ Contractor did not review and "APPROVE" submittal.	
☐ Other:	

Comments

1. See ARCHITECTS ACTIONS.
2. Contractor shall coordinate submittal information and schedule of the Work with all trades.
3. Dimensional and quantity mark-ups are intended to convey conformance with design concept expressed in the Contract Documents. Contractor remains responsible for given information provided within the Contract Documents and the coordination of all quantities and dimensions with the Work and the existing conditions.
4. See following page(s) for additional comments.

SECTION 01 3516 - ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes special procedures for alteration work.

1.2 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep an element or detail secure and intact.

L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.3 COORDINATION

A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.

1. Schedule construction operations in sequence required to obtain best Work results.
2. Coordinate sequence of alteration work activities to accommodate the following:

    a. Other known work in progress.
    b. Tests and inspections.

3. Detail sequence of alteration work, with start and end dates.
4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
5. Use of elevator and stairs.
6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.

1.4 PROJECT MEETINGS FOR ALTERATION WORK

A. Preliminary Conference for Alteration Work: Before starting alteration work, conduct conference at Project site.

1. Attendees: In addition to representatives of Owner, Architect, and Contractor, testing service representative, specialists, and chemical-cleaner manufacturer(s) shall be represented at the meeting.
2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:

    a. Alteration Work Subschedule: Discuss and finalize; verify availability of materials, specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Fire-prevention plan.
    c. Governing regulations.
    d. Areas where existing construction is to remain and the required protection.
    e. Hauling routes.
    f. Sequence of alteration work operations.
    g. Storage, protection, and accounting for salvaged and specially fabricated items.
    h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.
    i. Qualifications of personnel assigned to alteration work and assigned duties.

j. Requirements for extent and quality of work, tolerances, and required clearances.
k. Embedded work such as flashings and lintels, special details, collection of waste, protection of occupants and the public, and condition of other construction that affects the Work or will affect the work.

3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.

1.5 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1.6 INFORMATIONAL SUBMITTALS

A. Alteration Work Subschedule:

1. Submit alteration work subschedule within 30 days of date established for commencement of alteration work.

B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.

1.7 QUALITY ASSURANCE

A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to alteration work as specified in each Section and that has completed a minimum of five recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.

1. Field Supervisor Qualifications: Full-time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on-site when specialty work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.

B. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.

C. Safety and Health Standard: Comply with ANSI/ASSP A10.6.

1.8 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
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.

B. Salvaged Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.

E. Storage Space:

1. Arrange for off-site locations for storage and protection of salvaged material that cannot be stored and protected on-site.

1.9 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of preconstruction photographsand preconstruction videotapes.

1. Comply with requirements specified in Section 01 3233 "Photographic Documentation."

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

F. Existing Roofing: Prior to the start of work in an area, install roofing protection as indicated on Drawings.

3.2 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:

1. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.

    a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
2. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.

3. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
4. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

A. Have specialty work performed only by qualified specialists.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs or video recordings. Comply with requirements in Section 01 3233 "Photographic Documentation."

D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 01 3516

SECTION 01 4000 - 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 inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

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

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

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

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

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

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

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

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

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

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

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

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

1.4 CONFLICTING REQUIREMENTS

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

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

1.5 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data : For Contractor's quality-control personnel.

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

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

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.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Owner-performed tests and inspections indicated in the Contract Documents[, including tests and inspections indicated to be performed by the Commissioning Authority].

B. 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 work into compliance with standards of workmanship established by Contract requirements and approved mockups.

C. 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.

1.8 REPORTS AND DOCUMENTS

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

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

B. Manufacturer's 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, and telephone number 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 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, and telephone number 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 whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

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

1.9 QUALITY ASSURANCE

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

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

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

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

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

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

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

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

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

H. Manufacturer's 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 installation 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:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, 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 in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

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

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

L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.10 QUALITY CONTROL

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

1. 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. Contractor shall have prior experience within jurisdiction Work is to be performed and shall therefore have knowledge of jurisdictions quality control services required. Quality control services required by the AHJ shall be included within contract and shall not be considered for additional services or Change to the Contract.
2. Contractor shall engage a qualified testing agency to perform all quality control services unless otherwise indicated.

    a. Contractor shall 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 inspecting 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 inspecting 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. 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 01 3300 "Submittal Procedures."

C. 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.

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

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

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

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

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

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

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

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction and as required by individual specification sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

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

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

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

3.2 REPAIR AND PROTECTION

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

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 7300 "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 4000

SECTION 01 4200 - REFERENCES

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 DEFINITIONS

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

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

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

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

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

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

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

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

1.3 INDUSTRY STANDARDS

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

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

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

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

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

1.4 ABBREVIATIONS AND ACRONYMS

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

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

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

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.

14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

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

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program;www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.

6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 4200

SECTION 01 5000 - 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.

B. Related Requirements:

1. Section 01 1000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

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

B. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.

C. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.

D. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

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

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

C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.

D. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Waste handling procedures.
4. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

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

B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY OWNER USE FACILITIES

A. Owner Use Sleeping, Living, Wash (Toilet/Shower) Facilities: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading. Units shall be of sufficient size to accommodate needs of Owner; indicated as follows and on drawings:

1. Admin/Lounge Facility:

a. Shall be equipped with 4 small offices; approximately 8x10 feet (80 square feet) each.
b. Shall be equipped with a small kitchenette consisting of minimum 18 x 18 inch extra deep one compartment sink, minimum of 36 inches clear counter space, (2) 30 inch wide counter mounted microwaves, (2) standard full size refrigerators (36 inches wide), base and wall cabinets.
c. Shall be equipped with open lounge area to house (1) television and (11) recliners.
d. Contractor shall be responsible for disconnecting, cleaning, packaging, and moving Owner's existing furniture and appliances and installing all furniture and appliances within the offices, lounge area, and kitchenette of the temporary facilities.

2. Bunk/Sleeping Facility:

a. Shall be equipped with (2) single fully enclosed/separated bunk areas and a common bunk area accommodating 9 single (twin XL) beds and frames.
b. Contractor shall be responsible for packaging and moving Owner's existing furniture (11 twin XL bed frames and mattresses, 11 night stands) and installing all furniture within the sleeping rooms.

3. Wash Facility:

    a. Shall be equipped with (4) single occupant (separate) bathrooms including lavatory, toilet, and shower. Two bathrooms shall be ADA accessible.

4. Utilities: Contractor shall coordinate and install water, sewer, electrical, and where required by AHJ, fire protection services (fire protection services shall comply with all AHJ requirements) to each temporary facility. Services shall be maintained to the temporary facilities for the duration of construction or until such time the Owner occupies the newly constructed portions of the building. Upon Owner occupancy of the building or portions thereof sufficient to serve the same purposes as the temporary facilities, the Contractor shall remove the temporary facilities along with all associated services and patch/repair or otherwise finish/complete the Work as indicated within the Contract Documents.
5. Access: Contractor shall be responsible for constructing accessible ramp, stairs, and access deck/walkway to access the temporary facilities.
6. Permitting: Contractor shall be responsible for obtaining permits for temporary facilities. This Work shall include any/all documents required for permitting.
7. Owner use Contractor provided temporary facilities must be installed, complete, and able to be occupied prior to the Owner vacating the existing building. Owners operations cannot be interrupted during the course of construction.

    a. Owner shall install temporary alerting and dispatch systems including but not limited to devices and cabling within the contractor provided temporary facilities. Owner shall require a minimum of three (3) business days once the facilities are installed to perform the installation of these temporary systems. Using agency will not occupy the temporary facilities until the Owner has completed the installation of the alerting and dispatching systems.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 7700 "Closeout Procedures".

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

1. Locate facilities to limit site disturbance as specified in Section 01 1000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

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

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

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

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

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

    a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

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

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

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

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

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

K. Telephone Service: General Contractor's superintendant shall be to have a cellular telephone capable of sending and receiving text messages, e-mail, photographs, and of course telephone calls. .

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

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

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Construction personnel shall be responsible for finding and paying for legal parking at and/or around the site. No construction vehicles shall block or otherwise impede public ways, drives or intersections without previous written permission from the authority having jurisdiction.Provide temporary parking areas for construction personnel.

1. On-site parking shall be Emergency Services personnel and equipment only. Contractor personnel shall not be allowed to utilize any on-site parking.

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

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

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

1. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

   a. Provide temporary, directional signs for construction personnel and visitors.

2. Project Identification Sign: Provide project sign as directed by Owner general conditions, bidding documents, or other Contract Documents.

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

F. Waste Disposal Facilities: Comply with requirements specified in Section 01 7419 "Construction Waste Management and Disposal."

G. 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.

H. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 1000 "Summary."

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

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

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

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

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

H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

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

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Insulate partitions to control noise transmission to occupied areas.

3.5 MOISTURE AND MOLD CONTROL

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

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect 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 Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

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

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

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. 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 Section 01 7700 "Closeout Procedures."

END OF SECTION 01 5000

SECTION 01 6000 - 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. Section 01 2300 "Alternates" for products selected under an alternate.
2. Section 01 2500 "Substitution Procedures" for requests for substitutions.
3. Section 01 4200 "References" for applicable industry standards for products specified.

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. Products salvaged or recycled from other projects are not considered new products.

3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product. The Architect and Owner will have final approval whether or not products are comparable. Products will not be considered comparable when the Owner will be required to maintain an attic stock or maintenance stock of two similar/equal/comparable products that perform that same function but are not compatible or do not physically relate to one another. Example: The existing electrical system utilizes manufacturer A's breakers and panels but manufacturer B is submitted for all new breakers and panels thus requiring the Owner to maintain a maintenance stock of two different breakers. In this case manufacturer B is not comparable.

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

1.4 ACTION SUBMITTALS

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

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Section 01 3300 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 3300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

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

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 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 to determine that products are undamaged and properly protected.

C. Storage:

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

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

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 7700 "Closeout Procedures."

D. Product warranties shall be a minimum of 2 years from the date of Substantial Completion.

E. Contractor warranty period shall be a minimum of 2 years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. 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.
2. 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.
3. Products:

    a. Restricted List: 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 unless otherwise indicated.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: 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.
    b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 2500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 01 7300 - 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. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Requirements:

1. Section 01 1000 "Summary" for limits on use of Project site.
2. Section 01 3300 "Submittal Procedures" for submitting surveys.
3. Section 01 7700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 07 8413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

E. Certified Surveys: Submit two copies signed by land surveyor.

F. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: 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.

    a. Communication systems.
    b. Fire-detection and -alarm systems.
    c. Electrical wiring systems.
    d. 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.

    a. Water, moisture, or vapor barriers.

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. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 3100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.

B. General: Engage a land surveyor professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect and Construction Manager 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 and Construction Manager.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. 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 or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. 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.

D. 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.

E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. 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.

F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
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.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 7419 "Construction 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 assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 9113 "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 01 4000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 7300

SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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 the following:

1. Salvaging nonhazardous demolition construction waste.
2. Recycling nonhazardous demolition construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 04 2000 "Unit Masonry" for disposal requirements for masonry waste.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.6 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and 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 Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use . Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Waste reduction plan shall include at least 75% diversion of waste from landfills.

2. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
3. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
4. 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 (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 01 5000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 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.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 01 7419

SECTION 01 7700 - 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.
5. Repair of the Work.

B. Related Requirements:

1. Section 01 3233 "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Section 01 7300 "Execution" for progress cleaning of Project site.
3. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Section 01 7839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 01 7900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.

6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 7900 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 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 according to Section 01 2900 "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.

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 and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. 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.

4. Submit list of incomplete items in the following format:

    a. PDF electronic file. Architect will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

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, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

    1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 7419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 7700

SECTION 01 7823 - 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.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Section 01 3300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Section 01 7823a “Operation & Maintenance Manual Template” for organization, content, and appearance of Operation & Maintenance Manual described in this Section.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.

2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. Organize operations and maintenance manuals following the example template provided in 01 7823a "Operation and Maintenance Manual Template."

2. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

3. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return three copies.

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 will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
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. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. 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. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, post-type 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, subject matter of contents, and indicate Specification Section number on bottom of spine. 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. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

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

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. 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.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.

4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.

F. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 7823

[Insert PROJECT PHOTO here
Or Delete Box]

OPERATION & MAINTENANCE MANUAL

[**PROJECT NAME**]

[**PROJECT ADDRESS LINE 1**]

[**PROJECT ADDRESS LINE 2**]

Date of Substantial Completion: [Insert date]

Contractor: [COMPANY NAME]

[Contact Name]
[TITLE]
[ADDRESS LINE 1]
[ADDRESS LINE 2]
[PHONE #]
[FAX #]
[EMAIL]

Architect: Manns Woodward Studios, Inc.
Architect of Record: David Woodward, Principal

10839 Philadelphia Road, Suite D
White Marsh, Maryland 21162
PHONE: 410-344-1460
FAX: 443-403-2460
email: dwoodward@mwsarch.com

Insert **PROJECT NAME** here

OPERATION & MAINTENANCE MANUAL

Table of Contents

(continue to list each of Division and their subdivisions individually)

How to use this O&M Manual Template

1. Format the O&M Manual to follow the appearance and specific order of this example template in this order:
    a. Title Page.
    b. Table of Content Page.
    c. Project Directory Page.
    d. General Warranty Page.
    e. Required Maintenance Schedules Page(s).
    f. The following data for all specified finishes, materials, equipment, and systems that the Owner will require for operation, maintenance, and warranty references (organized individually by CSI Division and then by sub-division):
        i. Submittals, with review comments (product data, shop drawings, etc).
        ii. Warranty certificates.
        iii. Operation manuals.
        iv. Maintenance instructions.
        v. MSDS forms.
        vi. As-Built drawings.
2. Text appearing **[in brackets like this]** inside this template indicates text that the General Contractor must customize to suit the project and their company.
3. Generate the O&M Manual by computer, using a combination of typed-format word processor files and scanned PDF documents. Make a final version of the O&M Manual in a single PDF file (or one PDF file for each O&M volume, if it is split into 2 or more volumes).
4. Format the O&M Manual PDF version as described in the Specifications, using an 8 ½" x 11" size portrait layout so that the Owner may easily print portions of the PDF on any standard printer without the need for special paper (this does not apply to attached submittals that were formatted using other paper sizes – these should remain at their original paper size).
5. Deliver the O&M Manual to the Owner in PDF form, plus bound hardcopies if so indicated in the Project Specifications.

Additional Notes:

1. Format the PDF version with "Hyperlinks" or "Bookmarks" in the Table of Contents, so that the Owner can click on the name of an item in the TOC and go straight to that item.
    - **What is a Hyperlink?** A hyperlink is an active piece of text in the PDF, usually easily identified by blue text color and underlining, that will "jump" to either a specific section of the PDF or out to a separate file or web address when it is double-clicked. **If using Hyperlinks,** use them for every item in the Table of Contents so that the viewer can jump to the beginning of each referenced section of the O&M Manual directly from the TOC.

- **What is a Bookmark?** A bookmark is also a type of link, similar to a hyperlink, that jumps to a specific place in the PDF. Bookmarks only work inside of the PDF and cannot link to web addresses or external files, unlike hyperlinks. **If using Bookmarks,** use them for every item in the Table of Contents so that the viewer can jump to the beginning of each referenced section of the O&M Manual directly from the TOC.

2. If the O&M Manual must be hardcopy printed, follow the Specifications requirements, plus the following, unless the Specs say otherwise:
    a. Use 3-ring binders with page-lifters. Binders must not be wider than 3 inches. If the entire O&M will not fit in (1) 3-inch binder, use multiple volumes. Use identical new binders.
    b. Label the front and spine of every binder with typed, computer-generated labels. In addition to the project name and other required details, identify each volume individually on the labels.
    c. Provide a Table of Contents in the front of every volume. Each volume's TOC must list only that volume's contents.
    d. Use heavy-duty clear sheet protectors for the TOC, and for the As-Built Drawings, for durability.
    e. Separate each CSI Division in the O&M Manual using cardstock or stiff plastic dividers with labeled tabs projecting out of the document.
    f. Put page breaks between every individual package of materials to separate them from each other. All materials related to one item should be grouped together (for instance, vinyl floor tile product data, color and item number, warranty certificate, maintenance instructions, and MSDS form for floor polish).
    g. It is acceptable to print double-sided to reduce paper. *However,* every package of related materials (for instance, all of the materials for vinyl floor tile) must start on a new page.

DO NOT INCLUDE THIS INFORMATIONAL SECTION IN THE FINAL O&M MANUAL TO BE GIVEN TO THE OWNER.

PROJECT DIRECTORY

[PROJECT NAME]

[PROJECT ADDRESS LINE 1]
[PROJECT ADDRESS LINE 2]

OWNER

[COMPANY NAME]

[COMPANY ADDRESS LINE 1]
[COMPANY ADDRESS LINE 2]

	Business Phone	Mobile Phone	Email address
[John Doe, title]	[410-444-1111]	[443-444-2222]	[Jdoe@companyname.com]
[Jane Doe, title]	[410-444-2222]	[443-444-3333]	[jadoe@companyname.com]

GENERAL CONTRACTOR [CONSTRUCTION MANAGER]

[COMPANY NAME]

[COMPANY ADDRESS LINE 1]
[COMPANY ADDRESS LINE 2]

	Business Phone	Mobile Phone	Email address
[John Doe, title]	[410-444-1111]	[443-444-2222]	[Jdoe@companyname.com]
[Jane Doe, title]	[410-444-2222]	[443-444-3333]	[jadoe@companyname.com]

ARCHITECT

Manns Woodward Studios
10839 Philadelphia Road, Suite D
White Marsh, Maryland 21162

	Business Phone	Mobile Phone	Email address
Robert Manns, Principal	410-344-1460	410-917-5158	rmanns@mwsarch.com
David Woodward, Principal	410-344-1460	443-643-7249	dwoodward@mwsarch.com

DESIGN TEAM (List each of the design team individually)

Civil Engineer: [COMPANY NAME]
[ADDRESS LINE 1]
[ADDRESS LINE 2]

	Business Phone	Mobile Phone	Email address
[John Doe, title]	[410-444-1111]	[443-444-2222]	[Jdoe@companyname.com]
[Jane Doe, title]	[410-444-2222]	[443-444-3333]	[jadoe@companyname.com]

{INSERT CONTRACTOR'S COMPANY NAME AND/OR LOGO}

Structural Engineer: [COMPANY NAME]
[ADDRESS LINE 1]
[ADDRESS LINE 2]

	Business Phone	Mobile Phone	Email address
[John Doe, title]	[410-444-1111]	[443-444-2222]	[Jdoe@companyname.com]
[Jane Doe, title]	[410-444-2222]	[443-444-3333]	[jadoe@companyname.com]

Mechanical / Electrical / Plumbing Engineer: [COMPANY NAME]
[ADDRESS LINE 1]
[ADDRESS LINE 2]

	Business Phone	Mobile Phone	Email address
[John Doe, title]	[410-444-1111]	[443-444-2222]	[Jdoe@companyname.com]
[Jane Doe, title]	[410-444-2222]	[443-444-3333]	[jadoe@companyname.com]

SUB CONTRACTORS (List each subcontractor individually)

[Subcontractor Type]: [COMPANY NAME]
[ADDRESS LINE 1]
[ADDRESS LINE 2]

	Business Phone	Mobile Phone	Email address
[John Doe, title]	[410-444-1111]	[443-444-2222]	[Jdoe@companyname.com]
[Jane Doe, title]	[410-444-2222]	[443-444-3333]	[jadoe@companyname.com]

[Contractor's Company Name] Warranty

[January 1, 2000]

[Owner's Company Name]

[Project Address Line 1]

[Project Address Line 2]

Substantial Completion Date: [Date]

Attention: [Owner's Name]

[Owner's Name],

Sample Warranty:

(Body Text)

(Body Text)

(Body Text)

(Body Text)

(Body Text)

(Body Text)

[Salutation],

[Contractor name]

[Title]

REQUIRED MAINTENANCE SCHEDULES

[PROJECT NAME]

[**PROJECT ADDRESS LINE 1**]
[**PROJECT ADDRESS LINE 2**]

(Include all required maintenance in equipment and finishes in project.)

Division 08
Doors and Windows

(Sample Division Cover Page – print on cardstock divider with numbered tab.

Hyperlink or bookmark this tab in the Table of Contents.)

Division 08

Door Hardware

(Content should include all related items required by the Specifications)

[Sample]

Division 09
Finishes

(Sample Division Cover Page – print on cardstock divider with numbered tab.

Hyperlink or bookmark this tab in the Table of Contents.)

Division 09

Ceramic Tile

(Content should include all related items required by the Specifications)

[Sample]

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 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 Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. The requirements of this section shall be in addition to the requirements of Baltimore County any/all Baltimore County general conditions, design standards, or other similar Baltimore County requirements.

1. Contractor(s) shall be responsible to conform to the requirements of any/all Baltimore County general conditions, design standards, or other similar Baltimore County Requirements whether referenced within these specifications or other procurement or contract documents. These documents include but are not limited to the Baltimore County Design Manual, and the Baltimore County Design/Build Construction Services document. The Contractor shall provide all AS-BUILT information required within these standards/manuals and in the format required by these standards/manuals.
2. Contractor shall also provide all information described within this Section.

C. Related Requirements:

1. Section 01 7300 "Execution" for final property survey.
2. Section 01 7700 "Closeout Procedures" for general closeout procedures.
3. Section 01 7823 "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 and one of file prints.

    b. Final Submittal:

        1) Submit one paper-copy set(s) of marked-up record prints.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report [weekly]indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. 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.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. 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 and Construction Manager.
e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

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

END OF SECTION 01 7839

SECTION 01 7900 - 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. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

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

B. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit one copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name of Architect.
c. Name of Contractor.
d. Date of video recording.

2. At completion of training, submit complete training manuals for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on USB thumb drive.

1.5 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 01 4000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.6 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 has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

a. System, subsystem, and equipment descriptions.
b. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.
e. Equipment function.

f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:

a. Emergency manuals.
b. Operations manuals.
c. Maintenance manuals.
d. Project record documents.
e. Identification systems.
f. Warranties and bonds.
g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Required sequences for electric or electronic systems.
l. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.

b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 7823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

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.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.

1. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
2. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
3. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

    a. Produce segments to present a single significant piece of equipment per segment.
    b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

END OF SECTION 01 7900

SECTION 02 4113 - SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of the Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections apply to all work under this section.

B. Baltimore County Department of Public Works Standard Specifications for Construction and Materials, Dated January 2000 and as amended.

C. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated July, 2021 and as amended.

1.2 SUMMARY

A. Furnish all labor, materials, tools, equipment and services necessary for and reasonably incidental to complete the selective site demolition work as indicated on the drawings or specified.

B. General intent of selective site demolition work is indicated on drawings and described herein. Demolish and remove existing construction only to the extent required by new construction and as indicated.

C. This Section requires removal and disposal, off site, of the following:

1. Existing retaining wall, wall stem, brick veneer, concrete steps, sidewalk area. Existing wall concrete footing and stem reinforcing are to remain.

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

1. Division 1 Section "Summary of Work" for use of the building and phasing requirements.
2. Division 2 Section "Selective Structure Demolition" for cutting and patching procedures for selective demolition operations.
3. Division 1 Section "Construction Progress Documentation" for demolition schedule requirements.
4. Division 1 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures for selective demolition operations.
5. Division 1 Section " Photographic Documentation" for preconstruction photos.
6. Division 32 Section "Planting" for protecting trees remaining on-site.

7. Division 31 Section "Site Clearing" for site clearing and removing above, and below, grade improvements.
8. Division 31 Section "Excavation, Filling & Grading" for soil materials, excavating, backfilling, and site grading.
9. Division 23 Sections for cutting, patching, or relocating mechanical items.
10. Division 26 Sections for cutting, patching, or relocating electrical items.

1.3 REGULATORY REQUIREMENTS

A. Conform to current Baltimore County Building Code and other applicable codes for demolition, safety of structures, dust control, service utilities, and all discovered hazards to include asbestos and lead paint.

B. Obtain and have on file all required permits.

1.4 OWNERSHIP OF REMOVED MATERIALS

A. Prior to Notice of proceed, Owner will remove all equipment, materials and fixtures he wishes to retain. After which all equipment, material and fixtures become the property of the Contractor to be removed from the premises and disposed by the Contractor.

1.5 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Proposed schedule of operations coordination for shutoff, capping, and continuation of utility services as required.

1. Provide a detailed sequence of demolition and removal work to ensure uninterrupted progress of on-site operations.

C. Digital color photographs of existing adjacent structures and site improvements shall be submitted to the Architect. All photographs will be saved on USB flash drive and saved in JPEG file format with a file name to include calendar date, site or room taken (for example, 20190625-Bathhouse-MensLockerRm-Photo1.jpg).

1.6 JOB CONDITIONS

A. Demolition Phasing

1. The contractor shall prepare and submit a demolition/construction staging plan to the Engineer for approval prior to beginning any construction.

2. The contractor shall prepare and submit photographic documentation of the existing building exterior that is to remain during the work for approval prior to beginning any construction. Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 01 3233 "Photographic Documentation." Submit before Work begins.

B. Condition of Structures: Engineer assumes no responsibility for actual condition of structures to be demolished. Existing underground features and elevations are based on record drawings for the Fullerton firehouse building, dated 1971.

1. The Engineer assumes no responsibility for actual condition of structures to be demolished.
2. Conditions existing at time of inspection for bidding purpose will be maintained by Engineer insofar as practicable. However, variations within structure may occur by Engineer's removal and salvage operations prior to start of demolition work.

C. Salvage Materials: Items of salvable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

1. Storage or sale of removed items will not be permitted on site.

D. Explosives: Use of explosives will not be permitted.

E. Traffic: Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

F. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent damage to adjacent buildings, structures, and other facilities and injury to persons.

G. Damages: Promptly repair damages caused to adjacent facilities by demolition operations.

H. Utility Services: Maintain existing utilities indicated to stay in service and protect against damages during demolition operations.

1. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

1.7 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

B. Regulatory Requirements: Comply with notification regulations of authorities having jurisdiction before beginning removal and dismantling work. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. All work shall comply with the rules and regulations of Occupational Safety and Health Administration and all other Federal, State and County agencies and authorities having jurisdiction.

PART 2 - PRODUCTS -- NOT APPLICABLE

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide, erect and maintain temporary barricades, fences, security devices and other means of protection around work area in compliance with Federal, State, and County safety regulations.

B. Install or attached temporary warning signage as required or as directed by the Engineer.

C. Protect existing items and structures adjacent to area of the demolition and any existing items within limits of construction that are not indicated to be removed or demolished.

D. Protect from damage existing surfaces or materials to remain in place during demolition. Protect follows with suitable coverings when necessary. Any surface or materials to remain that are damaged during demolition shall be repaired or replaced by Contractor at no cost to the Owner.

E. Protect existing underground utilities during demolition operations. Call "Miss Utility" (800) 257-7777) at least 48 hours prior to starting work. Perform necessary test pits as required to complete the project. Existing utilities damaged during demolition operation shall be repaired at no cost to the Owner.

F. The Contractor shall be responsible for all damage or injury to property of any character during the prosecution of the work, resulting from any act, omission, neglect or misconduct in his manner or method of executing said work, or at any time due to defective work or materials, and said responsibility shall not be released until the work shall have been completed and accepted. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect or misconduct in the execution of the work or in consequence of the nonexecution thereof on the part of the Contractor, he shall restore, at his own expense, such property to a condition similar to, or equal to, that existing before such damage or injury, in an acceptable manner. In case of the failure on the part of the Contractor to restore such property or make good such damage or injury, the Architect may, upon 48 hours notice, proceed to repair, rebuild or otherwise restore such property as may be deemed necessary and the cost thereof will be deducted from any monies due or which may become due the Contractor under this Contract.

3.2 DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with existing roads and sidewalks designated to remain.

B. Conduct operations with minimum interference to public or private accesses.

C. Maintain protected egress and access at all times. Do not close or obstruct roadways or sidewalks without permits and/or by written approval by the Engineer. Obtain approval from the Engineer for egress and access plans prior to beginning demolition.

D. Cease operations immediately if adjacent structures or existing structures to remain appear to be in danger. Notify the Engineer.

E. Remove demolished materials from site at regular intervals as work progresses.

F. Do not burn any materials or debris on the project site.

G. Make every effort to keep to a minimum noise, dust, vibrations, and other activities which would bother the inhabitants in adjacent buildings.

H. Demolish work in such manner as to avoid hazard to persons and property. Prevent the spread of dust and flying particles by keeping work thoroughly wetted down; provide water and necessary connections therefore. Provide adequate protection of persons and property at all times. Provide for all temporary dust proof partitions where called for or as required to stop the flow of dust and debris from the area of construction into the inhabited areas.

I. Upon completion, leave the premises (and project site area) in a clean condition, free from hazards or unsightly appearances.

J Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air. Comply with governing regulations pertaining to environmental protection.

1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

J. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

K. Miscellaneous: Demolish additional miscellaneous existing site improvements indicated, specified and required to construct project.

L. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

M. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

N. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

O. Existing site improvements demolition:

1. Existing subsurface conditions: Verify existing conditions of each respective site during pre-bid inspection. Obtain written authorization from the Engineer before conducting test hole explorations of existing pavement surfaces or structures with the project site. Conditions existing during pre-bid inspections will not be altered or modified.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Remove daily from site accumulated debris, rubbish, and other materials resulting from demolition operations.

B. Burning of combustible materials from demolished structures will not be permitted on site.

C. Removal: Transport materials removed from demolished structures and legally dispose of offsite.

D. The contractor shall provide "dumpsters" for his own trash removal use. Dumpsters, when full, shall be promptly emptied, and refuse removed from the premises all at the contractor's cost.

3.4 EXCAVATION

A. Excavation and backfill required for demolition of piping and other utility structures shall conform to applicable specifications regarding utility construction. Excavate and expose existing underground utilities and related structures designated for, or as required to implement, removals. For excavation operations refer to Section 31 2300 - Excavating and Filling. For backfill operations refer to Section 31 2300 - Excavation and Filling.

END OF SECTION

SECTION 02 4119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 01 1000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 01 7300 "Execution" for cutting and patching procedures.
3. Section 01 3516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Engineering Survey: Submit engineering survey of condition of building.

C. 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.

D. 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.
4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

E. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 01 3233 "Photographic Documentation." Submit before Work begins.

F. 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.

G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

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

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Hazardous materials are not expected to be encountered in the Work Area. However, it shall be the responsibility of the Contractor to perform a Hazardous Materials Survey and test any/all suspected hazardous materials within all Work Areas and locations where Work shall be performed. The survey and testing are required to be performed by a certified licensed professional experienced in identifying and testing hazardous materials. Where suspected materials are positively identified to be hazardous materials, the Contractor shall be required to provide a Change Order Proposal for the development and execution of an abatement plan.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged.
2. 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.

F. Prior to any saw cutting or coring of the existing concrete slabs, the Contractor shall be responsible for scanning the proposed area of cutting and or coring plus two feet in either direction of said penetration(s) with ground penetrating radar scanning. In the event a conflict becomes apparent from the scan, the Contractor shall contact the Owner and or Architect of Record for further direction prior to any cutting or coring.

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 utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. 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.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 5000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

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. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 7419 "Construction Waste Management and Disposal."

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. Removed and Salvaged Items:

1. Clean salvaged items.
2. Store items in a secure area until delivery to Owner.
3. Transport items to Owner's storage area on-site.
4. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and 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 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. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

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. See Section for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove 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.
4. Comply with requirements specified in Section 01 7419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

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 4119

SECTION 03 1116.13 - ELASTOMERIC CONCRETE FORM LINER
I

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Construction of textured and colored formed concrete surfaces using simulated stone masonry molds and color stain system designed to duplicate closely the appearance of natural stone.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-in-place Concrete: Cast-in-place concrete, concrete reinforcements, accessories, curing, and form work. Quality standards specified in Section 03300 shall apply to concrete used for this Section.

B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

C. Baltimore County Department of Public Works Design Manual dated January 2000 and as amended.

D. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated July, 2021 and as amended.

1.3 DESIGN REQUIREMENTS

A. Design and pattern of the concrete surface shall follow the manufacturer's standard drawing. If an actual stone surface or stone wall to be matched is available, the completed colored and formed concrete surface shall match the natural material as closely as possible. Patterning of simulated stone masonry shall appear natural and non-repeating. Seam lines or match lines caused from two of more molds coming together will not be apparent when viewing final wall. Final coloration of cast stone concrete surface shall accurately simulate the appearance of real stone including the multiple colors, shades, flecking, and veining that is apparent in real stone. It shall also demonstrate the colors that may be apparent from aging, such as staining from oxidation, rusting and/or organic staining from soil and /or vegetation. Note that in part 1, SUBMITTAL and part 3, EXECUTION, a sample and mockup are required. Upon approval by Architect/Engineer and Owner, mockup shall serve as quality standard for the project.

1.4 SUBMITTAL

A. Sample Panel: Within 30 days of receiving the general contract, General Contractor is required to submit a 24" x 24" sample of the simulated stone masonry finish. Sample is to demonstrate the finish described in section 1.03, DESIGN REQUIREMENTS: Approval of sample panel is required by Architect/ Engineer and Owner.

B. Shop Drawings: Plan, elevation, and details to show overall pattern, joint locations, form tie locations, and end, edge and other special conditions.

C. Samples: Form ties, sample and description, showing method of separation when forms are removed.

1.5 QUALITY ASSURANCE

A. Manufacturer of simulated stone masonry molds and custom coloring system: Five years experience making stone masonry molds and color stains to create formed concrete surfaces to match natural stone shapes, surface textures, and colors.

B. Pre-Installation Meeting: Schedule a conference with manufacturer representative to assure understanding of simulated stone masonry, molds use, color application, requirements for construction of mockup, and to coordinate the work.

1.6 PROJECT CONDITIONS

A. Environmental requirements: Apply color stain when ambient temperatures is between 50 and 90 degrees F. Consult manufacturer if conditions differ from this requirement.

1.7 SEQUENCING

A. Schedule color stain application with earthwork and back-filling of any wall areas making sure that all simulated stone texture is colored to the minimum distance below grade . Delay adjacent plantings until color application is completed. Coordinate work to permit coloring applications without interference from other trades.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The specified system is based on the Custom Rock® Concrete Wall System, Custom Rock, St. Paul, Minnesota 55116, phone (651)699-1345, or equal as approved by the Department.

2.2 MATERIALS

A. Simulated masonry molds: Reusable and made of high-strength urethane, easily attachable to forms. Molds shall not compress more than 1/4 in. when concrete is poured at rate of 10 vertical feet per hour. Molds shall be removable without causing deterioration of surface or underlying concrete. The wall mold pattern shall be #1206 Royalite Stone by Custom Rock, St. Paul, MN (651) 699-1345.

B. The form liner shall attach easily to the forming system, and shall not compress more than 0.021 ft when poured vertically at a rate of 10 ft/hour. Provide liners capable of withstanding anticipated concrete pour pressures without leakage causing physical or visual defects. Provide liners that do not cause concrete surface deterioration or weakness in the substrate when removed.

C. Release Agent: Compatible with simulated stone masonry molds and with color stain system to be applied to surface. Consult manufacturer.

D. Form ties: Shall be made of either metal or fiberglass. Using metal ties, which result in a portion of the tie permanently embedded in the concrete, shall be designed to separate at least one inch back from finished surface, leaving only a neat hole that can be plugged with patching material. Contractor shall submit the type of form ties to the engineer, project designer, or Owner for approval prior to use in this work,

E. Mortar Joints: Joints shall be colored to simulate real mortar.

F. Color stain: Special stain mix as provided by manufacturer, shall achieve color variations present in the natural stone being simulated for this project, as required by Architect/Engineer and Owner as referenced in section 1.03 DESIGN REQUIREMENTS. Stain shall create a surface finish that is breathable (allowing water vapor transmission), and that resists deterioration from water, acid, alkali, fungi, sunlight or weathering. Stain mix shall be a water- borne, low V.O.C. material, less than 180 grams/liter. Select the stain from the SHA Qualified Products List maintained by the SHA Office of Materials Technology and the color number according to AMS-STD-595A or as approved by the Architect.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. Formed concrete construction: five years experience pouring vertically formed architectural concrete. Installer shall be trained in manufacturer's special techniques in order to achieve realistic surfaces.

B. Color stain system application: Manufacturer or manufacturer's authorized representative. A qualified concrete stain / color applicator with at least 5 years of multicolor experience. Provide a minimum of 3 recent projects in the local vicinity installed in the past 5 years.

3.2 CONSTRUCTION

A. Mockup: Build on site sixty days before work starts, using same materials, methods and work force that will be used for the project. Architect/Engineer and Owner will determine specific requirements and location. When applicable, sample panels are not to be fabricated until the form liner has been approved by the Architect for use on the project. Prior to fabrication or construction of elements to be used in the final structure, demonstrate workmanship by constructing an approved sample panel for the architectural treatment specified using approved form lining materials, surface coloring, aggregate, and/or absorptive finish. Provide sample panels at the project site for inspection and approval. Use the same formwork including form or wall ties proposed for use and concrete placement for the sample panel as that used for the finished structure. The form liner used shall produce the same pattern that is intended for use on the finished structure. When the finished structure will contain vertical or horizontal form liner seams/joints, the sample panel shall include the same appropriate seams/joints. Provide sample panel of unreinforced concrete cast in the same position (vertically or horizontally) as will be the finished product to determine the surface texture resulting by use of the form liner. Remove rejected samples from the project and submit a new sample at no additional cost to the Owner. The approved sample panel shall remain on the site as a basis for comparison to the structure.

1. Size: 50 sq. ft., or larger, if needed to adequately illustrate the pattern and texture selected.
2. Include an area to demonstrate wall mold butt joint and if appropriate, continuation of pattern through expansion joint.
3. If design includes stone texture across top of wall, include in mockup.
4. After concrete work on mockup is completed and cured for a minimum of 28 days, and after surface is determined to be acceptable for coloring, apply color stain system.
5. After coloring is determined to be acceptable by the Architect/Engineer and Owner, construction of project may proceed, using mockup as quality standard.

B. Contractor Uniformity Responsibility: The same architectural treatment or form liner shall be used throughout the project, in addition to the same concrete mix and provider. The staining process shall be used throughout the project. The Architects form liner approval process ensures that the specific form liner produces a product that conforms to the specified results. It does not relieve the Contractor of the responsibility for uniformity throughout the project. Apply architectural treatments as to not provide a detectable repeating pattern for the length of the element, unless this effect is desired by the Owner.

C. Inspection of Architectural Treatments / form liners : Inspect all elements to be used in the final structure for esthetic treatment acceptability at the fabrication plant prior to loading on shipping vehicle, when applicable. Inspections shall also be conducted upon delivery of elements at the project site.

3.3 SPECIAL TECHNIQUES - FORMING TEXTURED CONCRETE

A. Simulated Stone Masonry Molds preparation: Clean and make free of buildup prior to each pour. Inspect for blemishes or tears. Repair if needed following manufacturer's recommendations.

B. Simulated Stone Masonry Molds attachments: Place stone molds with less than 1/4 inch separation between them. Attach molds to form securely following manufacturer's recommendations.

C. Form release agent: Apply following manufacturers' recommendations so as not to be detrimental to the final structural appearance or the application of stain or other surface treatments.

D. Form stripping and related construction shall avoid creating defects in finished surface.

E. Where stone texture is to continue across top of wall, a finish to achieve a continuity of the formed pattern must be done by hand when concrete is being poured. Hand-carve and emboss the wet, pliable concrete, aligning rustication joints with those in the formed pattern. Great care must be taken to achieve intended relief and texture as per Architect/Engineer/Owners direction.

F. If the pattern selected has molds connecting through the middle of the stones, carefully remove the seam line created by abutting molds. Match the texture and shape of the surrounding stone, avoiding visible seams or mold marks.

G. Place form ties at thinnest points of molds (high points of finished wall). Neatly patch the remaining hole after disengaging the protruding portion of the tie so that it will not be visible after coloring the concrete surface.

H. Where an expansion joint must occur at a point other than at mortar or rustication joints, such as at the face of concrete texture, which is to have the appearance of stone, consult manufacturer for proper treatment of expansion material. Finish the joint material so as to visually continue the simulated stone/brick pattern uninterrupted. Include a sample of the colored expansion joint material in the sample panel for approval.

I. Carefully blend form liner butt joints into the approved pattern and finish off the final concrete surface. There shall be no visible vertical or horizontal seams or conspicuous form marks created by butt joining form liners. The finished texture, pattern, and color shall conform to the approved sample panel, and shall be continuous without visual disruption. The Architect may reject portion of the structure for failure to comply with these requirements. Remove rejected portions of the structure completely from the project at no additional cost to the Owner.

3.4 SPECIAL TECHNIQUES - APPLYING COLOR STAIN SYSTEM.

A. All Simulated Stone surfaces that are to be stained shall be at least 30 days old.

B. Clean surface prior to application of stain materials to assure that surface is free of latency, dirt, dust, grease, efflorescence, paint, or other foreign material, following manufacturer's instructions for surface preparation. Do not sandblast. Preferred method to remove latency is pressure washing with water, minimum 3000 psi (a rate of three to four gallons per minute), using fan nozzle perpendicular to and at a distance of one or two feet from surface. Completed surface shall be free of blemishes, discoloration, surface voids, and unnatural form marks.

C. Unless otherwise specified, apply two coats of concrete stain according to the manufacturer's recommendations and as directed.

3.5 PROTECTION

A. Where exposed soil or pavement is adjacent which may spatter dirt or soil from rainfall, or where surface may be subject to over spray from other processes, provide temporary cover of completed work.

3.6 FINAL AESTHETIC INSPECTION AND APPROVAL.

A. Obtain final aesthetic approval when project is complete. Contractor is responsible for structural aesthetic appearance until the project is accepted for maintenance by the Owner.

END OF SECTION

SECTION 03 3000 - CAST-IN PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, formwork, reinforcing, mixture design, placement procedures.
2. Cast-in-place concrete includes but is not limited to:

    a. Slabs-on-Grade/Ground
    b. Equipment Pads
    c. Poured-in-place retaining walls.

B. Related Documents:

1. Baltimore County Department of Public Works Standard Specifications for Construction and Materials, Dated January 2000 and as amended.
2. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated July 2021 and as amended.

C. Related Requirements:

1. Section 31 2300 "Earth Moving" for drainage fill under slabs-on-ground.
2. Section 32 1313 "Concrete Paving" for concrete pavement and walks.
3. Section 03 1116.13 "Elastomeric Concrete Form Liner" for retaining wall.
4. Section 07 1326 "Self-Adhering Sheet Waterproofing".

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete Subcontractor.
    e. Special concrete finish Subcontractor.

2. Review the following:

    a. Special inspection and testing and inspecting agency procedures for field quality control.
    b. Construction joints, control joints, isolation joints, and joint-filler strips.
    c. Semirigid joint fillers.
    d. Vapor-retarder installation.
    e. Anchor rod and anchorage device installation tolerances.
    f. Cold and hot weather concreting procedures.
    g. Concrete finishes and finishing.
    h. Curing procedures.
    i. Forms and form-removal limitations.
    j. Wall texture staining and colorization.
    k. Shoring and reshoring procedures.
    l. Methods for achieving specified floor and slab flatness and levelness.
    m. Floor and slab flatness and levelness measurements.
    n. Concrete repair procedures.
    o. Concrete protection.
    p. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
    q. Protection of field cured field test cylinders.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement
7. Aggregates.
8. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

9. Color pigments.
10. Fiber reinforcement.
11. Elastomeric concrete formliner.
12. Vapor retarders.
13. Floor and slab treatments.
14. Liquid floor treatments.
15. Curing materials.

    a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.

16. Joint fillers.
17. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Steel-fiber reinforcement content.
10. Synthetic micro-fiber content.
11. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
12. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
13. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
14. Intended placement method.
15. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. General: Contractor shall review and approve shop drawings prio to submission for A/E review. Only shop drawings bearing a stamp of the contractor, indicating that such a review has been completed and is approved, will be reviewed by the A/E.

2. Shop drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement.

    a. Drawings shall not be re-prints of the contract drawings.

3. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

    a. Location of construction joints is subject to approval of the Architect.

4. Working Drawing Approval : The Plans will be supplemented by working drawings as necessary to adequately control the work. All authorized alterations affecting the requirements and information given on the working drawings shall be in writing to the Engineer. Submit detail, form, falsework, and centering plans. Working drawings for forms shall include all members proposed for use as well as form ties and bracing. Do not submit details for form ties separately; incorporate them in the general working drawings submittal. The rate of placing concrete shall be noted on the working drawings. Approval of the working drawings does not relieve the Contractor of responsibility as specified in Md SHA and Baltimore County specifications.
5. The Contractor shall provide, at the Contractor's expense, all required working drawings and shall have them adequately checked after which they shall be submitted to the Engineer for review. The Engineer may reject working drawings and return them for revisions, in which case the Contractor shall submit revised working drawings as required. No items involving the drawings shall be incorporated into the work until those drawings have been accepted for use by the Engineer, however, acceptance shall not relieve the Contractor of any responsibility in connection therewith. All working drawings shall be furnished in duplicate for preliminary examination. After working drawings have been accepted for use by the Engineer, the Contractor shall furnish additional copies as requested. All working drawings shall be on sheets measuring 22 by 36 inches and shall have a standard title block at the lower right corner approximately 4 by 8 inches (2 inches for the revision column on the left side and the remaining 6 inches for the title) indicating the following information in the order named:
6. Name of Contractor (and Subcontractor, if applicable)
7. Address of Contractor (and Subcontractor, if applicable)
8. Sheet Title (Reinforcement Details, etc.)
9. Name of Structure Crossing For (Baltimore County)
10. By (Indicate name of Contractor's official or engineer, or other parties authorized to sign official documents.)
11. Schedule and distribute working drawings, which are described Md SHA and Baltimore County DPW specifications. Working drawings shall exhibit good drafting practices and represent the original work of the Contractor, fabricator, or supplier. Duplicated portions of the Plans will not be accepted. When requested submit calculations or other information deemed necessary to backup working drawings. Sign and seal calculations and other backup material by a professional engineer registered in the State of Maryland.

D. Working Drawings for Falsework Systems.

E. Falsework systems plans (design and construction) shall be the responsibility of the Contractor, including submitting and obtaining written acceptance of the design and plans by the Engineer before erection. The Contractor shall utilize a professional engineer (P.E.) registered in the State of Maryland who has a minimum of five years experience in falsework design for construction and repair. The falsework design calculations and plans shall be signed by the P.E. and bear the seal of the P.E. The submittal of the design and falsework plans shall include the P.E.'s resume showing evidence of the required experience. The P.E.'s plans and design calculations shall evaluate and qualify all products and components including manufactured products and proprietary items for their intended service. Acceptance by the Engineer of falsework systems shall not in any way relieve the Contractor of the responsibility for the safety and adequacy of the design and construction for the falsework systems and operations, including all components.

F. Samples: For form liner.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates, and 3 reference projects.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Curing compounds.
5. Bonding agents.
6. Adhesives.
7. Vapor retarders.
8. Semirigid joint filler.
9. Joint-filler strips.
10. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Silica fume.
5. Aggregates.
6. Admixtures:

a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

D. Preconstruction Test Reports: For each mix design.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who has a minimum of 5 years of verifiable experience installing cast in place concrete formed retaining walls, and who also has 5 years experience utilizing elastomeric plywood backed formliners on concrete retaining walls. Provide at least 3 similar projects previously completed as a reference. The Contractor shall employ sufficient labor and equipment for prosecuting the several classes of work to full completion in the manner and time required by the Contract. Workmen must have sufficient skill and experience to perform properly the work assigned to them. All workmen engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform all work properly and satisfactorily. Any person employed by the Contractor or by any subcontractor who, in the opinion of the Architect, does not perform his work in a proper manner or is intemperate or disorderly shall, at the written request of the Architect be removed forthwith by the Contractor or subcontractor employing such foreman or workman, and shall not be employed again in any portion of the work without the approval of the Architect. Should the Contractor fail to remove such person or persons as required above, or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the Architect may withhold estimates which are or may become due on the Contract until a satisfactory understanding has been reached. Equipment and materials to be used on the work shall meet the requirements of the work and produce a satisfactory quality of work. The Architect may order the removal and require replacement of any unsatisfactory equipment or materials. When the methods and equipment to be used by the Contractor in accomplishing the construction are not prescribed in the Contract, the Contractor is free to use any methods or equipment that he demonstrates to the satisfaction of the Architect will accomplish the Contract work in conformity with the requirements of the Contract.

B. Concrete wall stain colorization installer: A qualified concrete stain/color applicator with at least 5 years of multicolor experience. Provide a minimum of 3 recent projects in the vicinity installed in the past 5 years.

C. The installation contractor shall also be pre-qualified under Baltimore County DPW category D 4, for construction of reinforced concrete retaining walls over 3 ft in height.

D. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

E. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor to be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

F. Field Quality-Control Testing Agency Qualifications: The contractor shall hire an independent agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

G. Mockups: Cast concrete textured wall panels to demonstrate typical joints, surface finish, texture, tolerances, color treatments, and standard of workmanship. Mock-up stone texture sample to be approved by the Owner and Architect and installed on site. After proper cure period and preparation, the mock-up panel shall receive the stain colorization to be approved by the Architect and Owner.

H. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified.

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Bulding Code Requirements for Reinforced Concrete."
3. ACI 311, "Recommended Practice for COncrete Construction."
4. ACI, 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete."
5. ACI 315, "Manual of Standard Practice fro Detainling Reinforced Concrete Structures."
6. COncrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
7. Current IBC Code.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.
f. Permeability.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306, Md SHA Specifications section 420 and 902.10, and generally as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg Ffor three successive days, maintain delivered concrete mixture temperature within the temperature range required by Md SHA
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 305, Md SHA Specifications section 420 and 902.10, and generally as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.

3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Portland Cement: ASTM C 150, Type I.

1. Cementitious material for all concrete shall be a minimum of 75% Portland Cement.

C. Normal-Weight Aggregates: ASTM C33/C33M coarse aggregate or better, graded. Provide aggregates from a single source. For exposed exterior surfaces, do not use aggregate that contains substances that cause spalling.

1. Alkali-Silica Reaction: Comply with one of the following:

   a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
   b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
   c. Alkali Content in Concrete: Not more than 4 lb./cu. yd.for moderately reactive aggregate or 3 lb./cu. yd.for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301

2. Maximum Coarse-Aggregate Size: ¾ inch nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M certified by manufacturer to be compatible with other required admixtures.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. High-Range Water reducing Admixture: ASTM C 494, Type F or Type G.
3. Water Reducing, Accelerating Admixture: ASTM C 494, Type E.
4. Water Reducing, Retarding Admixture: ASTM C 494, Type D.
5. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
6. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C494/C494M, Type C.

F. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments, color stable, nonfading, and resistant to lime and other alkalis.

1. Color: As selected by Architect from manufacturer's full range.

G. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal framed plywood faced, or other acceptable panel type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

B. Forms for Unexposed Finish Concrete (Footings): Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

2.4 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615 Grade 60, deformed.

B. Steel Wire: ASTM A 82, plain, cold drawn steel.

C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

D. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wore fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2.5 CURING MATERIALS

A. Retaining wall sections shall be wet cured with continuously soaked cotton filled burlap mats or other acceptable mats to retain moisture, according to Md SHA specifications section 420.

B. Sidewalk sections may be cured by method of curing compound.

C. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd.when dry.

D. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F: Black.
b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
c. Ambient Temperature Above 85 deg F: White.

E. Water: Potable or complying with ASTM C1602/C1602M.

F. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: per MD SHA Standard Specifications for Construction, Section 460.

B. Liquid Membrane-Forming Curing Compound: Liquid-type membrane forming curing compound complying with ASTM C 309, Type I, Class A. Moisure loss not more than 0.55 kg/sq. m. when applied to at 200 sq ft./gal (4.9 sqm/L)

C. Water Based Acrylic Membrane Curing Compound: ASTM C 309 Type I, Class B.

1. Provide material tha has a maximum volatile organic compound (VOC) rating of 350 g/L.

D. Evaporation Control: Monmolecular folm-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

E. Bonding Agent: Polyvinyl acetate or acrylic base.

F. Epoxy Adhesive: ASTM C 881, two component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

G. Penetrating Liquid Floor Treatment: Chemically reactive, waterbourne solution of inorganic silicate of siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products: Subjec tto compliance with requirements, provide one of the followinf:

a. Masterseal SL 40 VOC; Master Builders
b. Chemsil Plus; ChemMasters
c. Euco Diamond Hard; Euclid Chemical Co.
d. Seal Hard; L&M Construction Chemicals, Inc.
e. Day-Chem Sure Hard; Dayton Supoerior Corporation.

H. Joint Filler Strips: ASTM D 1751, asphalt saturated cellulosic fiber, or ASTM D 1752, cork or self expanding cork.

I. Clear, Solvent-Bourne, membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type I, Class A.

J. Granular Fill: Granular fill beneath slab-on-grade to be a clean mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448, size 57, with 100 percent passing a 1-1/2 inch sieve and 0 to 5 percent passing and No. 8 sieve.

2.7 REINFORCING STEEL

A. All reinforcing steel shall comply with Md SHA specifications section 421.

2.8 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

a. Do not use the same testing agency for filed qualty control testing.

2.9 CONCRETE MIXTURES

A. All concrete shall meet the properties of MD SHA Mix #3, 3500 psi 28 day strength minimum unless more stringent requirements are indicated or specified.

B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.

C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when Characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

D. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:

1. 4000 psi, 28 day compressive strength; water cement ratio, 0.51 maximum (non-air-entrained), 0.40 maximum (air-entrained.)

E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Not more than 3 inches.

2.10 ADMIXTURES

A. Use water reducing admixture or high range water reducing admixture (super-plasaticizer) in concrete, as required, for placement and workability.

B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F.

C. Use admixtures for water reduction and set acceperating or retarding in strict compliance with manufacturer's directions.

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, Md SHA specifications section 420, and furnish batch ticket information.

1. When air tempreature is between 85 deg F and 90 deg F, reduce mixing and delivery time form 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 FORMS

A. General: Design erct, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads tha might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

1. Provide Class A tolerances for concrete surfaces exposed to view.
2. Provide Class C tolerances for other concrete surfaces.

B. Fabricate forms for easy removal without hammering or prying against concrete surfaces.

C. Chamfer exposed corners and edges as oindicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

D. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

E. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.4 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended pratice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and support and as specified.

1. avoid cutting or puncturing vapor retarder during reinforcement placement and concreting operations. Repair damages before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.

D. Place reinforcement to maintain minimum coverage as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concret placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

3.5 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.6 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Use bonding agent on existing concrete surfaces wthat will be joined with fresh concrete.

C. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs on grade at points of contact between slabs on grade and vertical surfaces, such as column pedestals, foundation walls, and other locations as indicated.

1. Extend joint filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full width joint filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are indicated.
3. Install joint filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

D. Contraction Joints in Slabs-on-Grade: Construct contraction joints in slabs on grade to form panels of patterns as shown. Use saw cuts 1/4 inch wide by one-fourth of lsab depth or inserts 1/4 inch wide by one fourth of slab depth, unless otherwise indicated,

1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
3. If joint pattern is not shown, provide joints not exceeding f15t. in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays.)

E. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

a. Continue reinforcement across construction joints unless otherwise indicated.
b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inchesinto concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

F. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

G. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.

H. Forms at Construction Joints and Corners

1. Provide ties or bolts 3 in. to 6 in. from each side of construction joints for tightening the forms against the hardened adjacent concrete prior to placing fresh concrete. At joints where forms have been removed and reconstructed, extend the form over the concrete already in place; and draw tightly against the previously placed concrete. Provide fillets at all sharp corners, except when otherwise specified, and provide a bevel or draft in the case of all projections. Chamfer all exposed corners of concrete with 3/4 in. x 3/4 in. milled chamfer strips, except on unexposed footings or where specified.

3.7 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, non-residual, lw-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating materil to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturers instructions.

3.8 CONCRETE PLACEMENT

A. General: Comply with ACI 304 "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

B. Equipment - Use equipment of sufficient capacity to complete any unit or section of concrete between construction joints in one continuous operation consistent with approved placement operations.

C. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

D. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

E. Avoid segregation of the material and the displacement of the reinforcement. Where placing operations involve dropping the concrete more than 5 ft, deposit it through a tube made of sheet metal, canvas, or other approved material. Do not use aluminum hoppers or tubes. Keep lower ends as close as possible to the newly placed concrete but not more than 3 ft above the concrete. All tubes shall be at least 6 in. diameter unless otherwise directed. Do not disturb the forms after initial set of the concrete, and do not place any strain on the projecting ends of the reinforcement.

F. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

G. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 and Md SHA, but not to exceed the amount indicated on the concrete delivery ticket.

H. Deposit concrete continuously in one layer or in horizontal layers not more than 12 in. high so that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inchesinto preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.

d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

I. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

J. Prior to subsequent placement, clean all accumulations of mortar splashed upon the reinforcement. Avoid damaging the concrete seal bond near and at the surface of the concrete while cleaning the reinforcing steel.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth Formed Finish: Provide a smooth formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

3.10 MONOLITHIC SLAB FINISHES

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, and where indicated.

1. After palcing slabs, finish surfaces to tolerance of F(F) 30 (floorflatness) and F(L) 20 (floor levelness) measured according to ASTM E 1155. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finsh and other finishes as specified; and where indicated.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared , or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power driven floats or by hand floating if area is small or inaccessible to power units. FInish surfaces to tolerances of F(F) 30 (floor flatness) and F(L) 20 (floor levelness) measured according to ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Trowel Finish: Apply a trowel finish monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, or ceramic tile.

1. After floating, begin first trowel-finish operation using a power driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerance of F(F) 30 (floor flatness and F(L) 20 (floor levelness) measured according to ASTM E 1155. Grind smooth any surface defects that would telegraph through applied floor covering system.

D. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surface indicated and to surface where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still palstic, slightly carify surface with a fine broom.

E. Broom FInish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in palce. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown in drawings. Set anchor bolted for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.12 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301, ACI 306.1 and MD SHA specifications for cold weather protection during curing.
2. Comply with ACI 301ACI 305.1 and MD SHA specifications for hot weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h,calculated in accordance with ACI 305.1, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.

C. Curing Unformed Surfaces: Comply with ACI 308.1as follows:

1. Begin curing immediately after finishing concrete.

    a. Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than four days, utilizing one, or a combination of, the following:

        1) Water.
        2) Continuous water-fog spray.

D. Applying curing compound on exposed interior slabs as follows:

1. Apply curing compound to concrete slabs as soon as as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared.) Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during with curing period.
2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

3.13 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare apply and finish penetrating liquid floor treatment according to manufacturer's written instruction.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if the surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 TOLERANCES

A. Conform to ACI 117

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas immediately after removing forms, when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inchin any dimension to solid concrete.

    a. Limit cut depth to 3/4 inch

b. Make edges of cuts perpendicular to concrete surface.
c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
d. Fill and compact with patching mortar before bonding agent has dried.
e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

C. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

D. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing Agency: The contractor shall engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

1) Project name.
2) Name of testing agency.
3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
4) Name of concrete manufacturer.
5) Date and time of inspection, sampling, and field testing.
6) Date and time of concrete placement.
7) Location in Work of concrete represented by samples.

8) Date and time sample was obtained.
9) Truck and batch ticket numbers.
10) Design compressive strength at 28 days.
11) Concrete mixture designation, proportions, and materials.
12) Field test results.
13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
14) Type of fracture and compressive break strengths at seven days and 28 days.

B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 4 cu. yd.but less than 10 cu. yd.plus one set for each additional 10 cu. yd.or fraction thereof.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

3. Slump Flow: ASTM C1611/C1611M:

    a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    b. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;

    a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M:

    a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

6. Compression Test Specimens: ASTM C31/C31M:

    a. Cast and laboratory cure two sets of two 6-inch by 12-inch cylinder specimens for each composite sample. The contractor has the option of casting additional sets of specimens should they desire earlier break results.

7. Compressive-Strength Tests: ASTM C39/C39M.

    a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
    b. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. 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 if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests:

    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

        1) Acceptance criteria for concrete strength to be in accordance with ACI 301,Section 1.6.6.3.

11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.17 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.

4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.

3.18 LOADS ON CONCRETE STRUCTURES

A. Do not place backfill on any new portion of wall until the final section of that unit has completed its specified curing period, all forms are removed, and concrete in that section has reached a compressive strength of 3000 psi.

END OF SECTION 03 3000

SECTION 04 2200 - CONCRETE UNIT MASONRY

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. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Embedded flashing.
6. Miscellaneous masonry accessories.

B. Related Requirements:

1. Section 07 1900 "Water Repellents" for water repellents applied to unit masonry assemblies.
2. Section 07 6200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Weep holes/vents.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties.
b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellant used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports 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/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements. It is the Contractors responsibility to determine sequence of work and project schedule. As such it is the Contractors responsibility to provide within their work scope cold weather and/or hot weather procedures as erquired to complete the work within the approved schedule.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

1.8 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.

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.

1.9 FIELD 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.

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 TMS 602/ACI 530.1/ASCE 6.

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 TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 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. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide bullnose units for outside corners of exposed units unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for units that are exposed and may be subject to direct water contact whether units are interior or exterior. Interior units subject to direct water contact may include but are not limited to units within garage/apparatus bays or sallyports, areas adjacent to or serving garage/apparatus bays or sallyports, areas with sinks or other water sources. Where block units are water repellent as a result of the manufacturing process or unit composition and where warranted by the manufacturer as such, the addition of water repellent will not be required.

C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 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: Provide color and texture matching the range represented by Architect's sample.

2.5 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, 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.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Cement: ASTM C 1329/C 1329M.

1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Lafarge North America Inc.; Magnolia Superbond Mortar Cement.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.

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. Davis Colors; True Tone Mortar Colors.
b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
c. Solomon Colors, Inc.; SGS Mortar Colors.

F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Essroc, Italcementi Group; Riverton Portland Cement Lime Custom Color.
2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
3) Lafarge North America Inc.; Eaglebond Portland & Lime.
4) Lehigh Cement Company.; Lehigh Custom Color Portland/Lime Cement.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of portland cement by weight.
4. Pigments shall not exceed 5 percent of mortar cement by weight.

G. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Aggregate for Grout: ASTM C 404.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, 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. BASF Corporation Chemicals - Building Systems; Trimix-NCA.
b. Euclid Chemical Company (The); an RPM company; Accelguard 80.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ACM Chemistries; RainBloc for Mortar.
b. BASF Construction Chemicals - Building Systems; Rheopel Mortar Admixture.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

K. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars 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. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
b. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
c. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch diameter.
4. Wire Size for Cross Rods: 0.187-inch diameter.
5. Spacing of Cross Rods: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.8 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

D. Partition Top Anchors: 0.105-inch- thick metal plate with a 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.

E. 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 A 153/A 153M.

2.9 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Copper-Laminated Flashing: 7-oz./sq. ft. copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Advanced Building Products Inc.; Copper Sealtite 2000.
2) Hohmann & Barnard, Inc.; Copper Fabric Flashing.
3) York Manufacturing, Inc.; Multi-Flash 500.

2. Stainless Steel Core Flashing: Stainless steel sheet with drainage fabric bonded to one face.

a. Performance Characteristics:

1) Tensile Strength: Stainless steel 100,000 psi average
2) Puncture Resistant: Stainless steel 2,500 psi average
3) When tested as manufactured, product resists growth of mold pursuant to test method ASTM D 3273
4) Fire Rating: Flame spread and smoke generation class A, ASTM E84

b. Products: Subject to requirements, provide one of the following:

1) York Manufacturing; Flashvent SS
2) STS Coatings, Inc.; Wall Guardian Venting Stainless Steel TWF

B. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing or flexible flashing with a metal drip edge.
4. Where flashing is fully concealed, use flexible flashing.

C. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.

1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Mortar Net USA, Ltd.; Blok-Flash.

D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 07 6200 "Sheet Metal Flashing and Trim."

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

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: 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 1/2 inch less than depth of outer wythe, in color slected from manufacturers full range of standard colors.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Advanced Building Products Inc. Mortar Maze Weep Vent
2) Blok-Lok Limited; Cell Vent
3) Hohmann & Barnard, Inc.; Quadro Vent
4) Wire-Bond; Cell Vent

E. Cavity Drainage Material: Free-drainagemesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requriements, provide one of the following:

    a. Advanced Building Products Inc.; Mortar Break II
    b. Achovations Inc; CavClear Masonry Mat
    c. Keene Building Products; Cav-Air-ator

2. Provide sheets or strips not less than 1 inch thick and installed to the full height of the cavity wall.

2.11 CAVITY WALL INSULATION

A. Extruded Polystyrene Board Insulation with Increased R-value: ASTM C 578, Type IV but with aged thermal resistance (R-value) for 1 inch thickness of 5.6 deg F x h x sq. ft./btu at 75 deg F at 5 years; closed cell product with a carbon black filler and extruded with an integral skin.

B. Adhesive: Type as recommended by insulation board manufacturer for application indicated.

2.12 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.
2. Use portland cement-lime or mortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

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 C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S.
4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
5. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of mortar cement by weight.
3. Mix to match Architect's sample.
4. Application: Use pigmented mortar for exposed mortar joints with the following units:

a. Decorative CMUs.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

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 would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

D. Units shall not be mitered to form corners unless otherwise noted.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For 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.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 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 Masonry: Unless otherwise indicated, 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 space between steel frames and masonry solidly with mortar unless otherwise indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

H. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 8413 "Penetration Firestopping."
5. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 8443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs 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.

B. Lay solid CMUs 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. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Wet joint surfaces thoroughly before applying mortar.
3. Rake out mortar joints for pointing with sealant.

D. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

G. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 CAVITY WALLS

A. Bond wythes of cavity wall together using one of the following methods:

1. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

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 protrusions into cavity.

C. Coat cavity face of backup wythe with fluid applied vapor barrier/weather barrier.

D. Install Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. each way, on inside face of insulation boards, or attach with plastic fasteners designed as part of the wall anchor system 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: 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. Cut and bend reinforcing units as directed by manufacturer for continuity at[corners,] returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

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. 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.
2. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall 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 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. At lintels, 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.
3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 9200 "Joint Sealants" for application indicated.
4. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 9200 "Joint Sealants" for application indicated.
5. 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.
6. Install metal flashing termination 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 flashing termination.
7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 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 TMS 602/ACI 530.1/ASCE 6.

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 TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches .

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor shall engage special inspectors to perform tests and inspections and prepare reports. Allow inpsectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level C in TMS 402/ACI 530/ASCE 5.

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.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

E. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

F. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.13 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.14 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. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 2200

SECTION 04 2613 - MASONRY VENEER

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. Clay face brick.
2. Mortar.
3. Ties and anchors.
4. Embedded flashing.
5. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

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

C. Related Requirements:

1. Section 07 6200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Clay face brick, in the form of straps of five or more bricks.
2. Colored mortar.
3. Weep holes/vents.

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

1. Clay face brick, in the form of straps of five or more bricks.
2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Weep holes and vents.
4. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties material test reports substantiating compliance with requirements.

2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 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.

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.

F. Do not use salt or calium chloride to remove ice from masonry surfaces.

1.8 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of veneer, 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 face of veneer, and hold cover securely in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with 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.

C. 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 TMS 602/ACI 530.1/ASCE 6.

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.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.

2.3 BRICK

A. Clay Face Brick: Facing brick complying with ASTM C216.

1. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
2. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
3. Application: Use where brick is exposed unless otherwise indicated.
4. Color and Texture: Match existing adjacent brick veneer.

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, 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.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Cement: ASTM C1329/C1329M.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

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. Davis Colors.
b. Euclid Chemical Company (The); an RPM company.
c. Lanxess Corporation.
d. Solomon Colors, Inc.

F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

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) Essroc.
2) Holcim (US) Inc.
3) Lafarge North America Inc.
4) Lehigh Hanson; HeidelbergCement Group.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of portland cement by weight.
4. Pigments shall not exceed 5 percent of mortar cement by weight.

G. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

H. 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. 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 Corp. - Construction Chemicals.
b. Euclid Chemical Company (The); an RPM company.
c. GCP Applied Technologies Inc.

I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

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. ACM Chemistries.
b. BASF Corp. - Construction Chemicals.
c. Euclid Chemical Company (The); an RPM company.
d. GCP Applied Technologies Inc.

J. Water: Potable.

2.5 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Seismic Screw-Attached, Masonry Veneer Anchors: Wire tie and corrosion resistant, self drilling, double barrel, thermal, dual seal screw with steel reinforced plastic coated wings to receive wire tie. Screw has adjustable spacer and gasketed washer(s) to seat directly against installation and masonry back-up/air barrier respectively.

a. Basis of Design Product: Subject to compliance with requirements, provide Hohmann & Bernard, Inc Thermal Concrete 2-Seal Wing Nut Anchor with Seismic Hook or comparable product by another manufacturer.

1) Anchor Barrel Finish: Stainless Steel; Type 304

2) Hook Finish: Stainless Steel; Type 304
3) Continuous Wire: 9 Ga. Stainless Steel; Type 304

2.6 EMBEDDED FLASHING MATERIALS

A. Embedded flashing materials shall be as specified in SECTION 04 2200 "Concrete Unit Masonry."

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Unless indicated below, miscellaneous masonry accessories shall be as specified in SECTION 04 2200 "Concrete Unit Masonry."

2.8 MASONRY CLEANERS

A. Masonry cleaners shall be as specified in SECTION 04 2200 "Concrete Unit Masonry."

2.9 MORTAR 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.
2. Use portland cement-lime mortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

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. Use Type N unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type S.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of mortar cement by weight.
3. Application: Use pigmented mortar for exposed mortar joints.

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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

B. 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.

C. 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.

D. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For 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.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

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 Masonry: Unless otherwise indicated, 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.

3.5 MORTAR BEDDING AND JOINTING

A. Lay solid masonry units 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.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed connector sections and continuous wire in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

B. Provide not less than 1 inch of airspace between back of masonry veneer and face of insulation.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 EXPANSION JOINTS

A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

B. Form expansion joints as follows:

1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 07 9200 "Joint Sealants."

3.8 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, 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 vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as indicated in SECTION 04 2200 "Concrete Unit Masonry."

C. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/vent products to form weep holes.
2. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.10 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. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean stone trim to comply with stone supplier's written instructions.
7. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.11 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 2613

PART 1 - SECTION 05 1200 – STRUCTURAL STEELGENERAL

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 structural steel and architecturally exposed structural steel.

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

1. Division 1 Section "Quality Control" for independent testing agency procedures and administrative requirements.
2. Division 5 Section "Metal Fabrications" for loose steel bearing plates and miscellaneous steel framing.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Original Shop Drawings detailing fabrication of structural steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
4. Shop drawings shall not be reprints of the contract drawings. The contractor shall review shop drawings for compliance with the contract documents and for coordination among the various trades. No shop drawings shall be submitted for A/E review without the contractor's stamp, indicating that such a review has been made.

C. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Mill test reports for structural steel, including chemical and physical properties, signed by manufacturers certifying that their products, including the following, comply with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
2. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
3. ASTM A 6"Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
4. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."

1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 SEQUENCING

A. Verify existing field conditions and existing field dimensions prior to fabrication.

B. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - - PRODUCTS

2.1 MATERIALS

A. Structural Steel Shapes, Plates, and Bars: As follows:

1. Miscellaneous Shapes, Plates, and Bars : ASTM A 36.
2. Wide Flange and WT Shapes: ASTM A 992, Grade 50.

B. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.

C. Hot-Formed Structural Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Type E or S, Grade B.

1. Weight Class: As indicated.
2. Finish: Black, except where indicated to be galvanized.

E. Carbon-Steel Castings: ASTM A 27, Grade 65-35, medium-strength carbon steel..

F. Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Unheaded Rods: ASTM A 36
2. Headed Bolts: ASTM F1554 Grade 36ksi, carbon-steel, hex-head bolts; and carbon-steel nuts.
3. Headed Bolts: ASTM A 325, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
4. Washers: ASTM A 36.

G. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

2.3 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

2.4 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Camber structural steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
7. Verify existing field conditions and existing field dimensions prior to fabrication.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded.

C. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

D. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

2.5 SHOP CONNECTIONS

A. Shop install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.

2.6 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to receive sprayed-on fireproofing.
4. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:

1. SSPC-SP 2 "Hand Tool Cleaning."
2. SSPC-SP 3 "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A 1

PART 3 - - EXECUTION

3.1 EXAMINATION

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Contractor will engage an independent testing and inspecting agency, acceptable to the architect, to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option, except that ultrasonic inspection shall be performed for at least 25% of full penetration welds. Should any of the 25% tested fail inspection, the owner may, at his option, require that a higher percentage, up to 100%, be tested by ultrasonic inspection.

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
4. Ultrasonic Inspection: ASTM E 164.

3.6 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

END OF SECTION 05 1200

SECTION 05 3100 – STEEL DECK

1.1 - GENERAL

A. RELATED DOCUMENTS

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

B. SUMMARY

1. A. This Section includes the following:

   a. Steel roof deck.

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

   a. Division 1 Section “Quality Control” for independent testing agency procedures and administrative requirements.
   b. Division 3 Section "Cast-in-Place Concrete" for concrete fill and reinforcing steel
   c. Division 5 Section "Metal Fabrications" for framing openings with miscellaneous steel shapes.
   d. Division 5 Sections “Structural Steel”.

C. SUBMITTALS

1. A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
2. B. Product data for each type of deck, accessory, and product specified.
3. C. Original shop drawings showing layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction. Shop drawings shall not be reprints of the contract drawings. The Contractor shall review shop drawings for compliance with the contract documents and for coordination among the various trades. No shop drawings shall be submitted for A/E review without the Contractor’s stamp, indicating that such a review has been made.
4. D. Product certificates signed by manufacturers of steel deck certifying that their products comply with specified requirements.
5. E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

D. QUALITY ASSURANCE

1. A. Installer Qualifications: Engage an experienced Installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
2. B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
3. C. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."

    a. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

E. DELIVERY, STORAGE, AND HANDLING

1. A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
2. B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - - PRODUCTS

2.1 MANUFACTURERS

A. A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

H.H.Robertson
Roof Deck, Inc.
United Steel Deck, Inc.
Vulcraft Div. of Nucor Corp.
Wheeling Corrugating Co., Div. of Wheeling-Pittsburgh Steel Corp.
New Millennium
ROOF DECK

B. A. Steel Roof Deck: Fabricate panels without top-flange stiffening grooves conforming to SDI Publication No. 28 "Specifications and Commentary for Steel Roof Deck" and the following:

Galvanized-Steel Sheet: ASTM A 653 SQ, Grade 33, G 90**zinc coated according to** ASTM A 924**.**

Deck Profile: Type WR, wide rib.

Profile Depth: As indicated.

Design Uncoated-Steel Thickness: As indicated

Span Condition: Triple span or more.

Side Joints: Overlapped.

2.3 ACCESSORIES

C. A. General: Provide accessory materials for steel deck that comply with requirements indicated and recommendations of the steel deck manufacturer.

D. B. Side Lap Fasteners: Manufacturer's standard, corrosion-resistant, hexagonal washer head; self-drilling, carbon steel screws, No. 10 minimum diameter.

E. C. Miscellaneous Roof Deck Accessories: Steel sheet, 0.0359-inch- thick minimum ridge and valley plates, finish strips, and reinforcing channels, of same material as roof deck.

F. D. Weld Washers: Manufacturer's standard uncoated-steel sheet weld washers, shaped to fit deck rib, 0.0598 inch thick with 3/8-inch minimum diameter prepunched hole.

G. E. Recessed Sump Pans: Manufacturer's standard size, single piece steel sheet 0.071-inch-thick minimum, of same material as deck panels, with 1-1/2-inch-minimum deep level recessed pans and 3-inch-wide flanges. Cut holes for drains in the field.

H. F. Flat Receiver Pan: Manufacturer's standard size, single-piece steel sheet, 0.071-inch-thick minimum units, of same material as deck panels. Cut holes for drains in the field.

I. G. Steel Sheet Accessories: ASTM A 653 SQ, G 60coating class, galvanized according to ASTM A 924.

J. H. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

EXAMINATION

K. A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

PREPARATION

L. A. Locate decking bundles to prevent overloading of supporting members.

INSTALLATION, GENERAL

M. A. Install deck panels and accessories according to applicable specifications and commentary of SDI Publication No. 28, manufacturer's recommendations, and requirements of this Section.

N. B. Place deck panels on supporting framing and adjust to final position with ends accurately aligned and bearing on supporting framing before being permanently fastened. Do not stretch or contract side lap interlocks.

O. C. Place deck panels flat and square and fasten to supporting framing without warp or deflection.

P. D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to the decking.

Q. E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

R. F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work..

ROOF DECK INSTALLATION

S. A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches long, and as follows:

Weld Diameter: 5/8 inch**, nominal.**

Weld Spacing: Weld edge ribs of panels at each support. Space welds an average of 12 inches **apart, with a minimum of two welds per unit at each support.**

T. B. Side Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding 36 inches, using one of the following methods:

1. **Mechanically fasten with self-drilling** No. 10-**diameter or larger carbon steel screws.**
2. **Fasten with** 1-1/2-inch-**long minimum welds.**

U. C. End Bearing: Install deck ends over supporting framing with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. **End Joints: Lapped** 2 inches **minimum.**

V. D. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking, and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.

FIELD QUALITY CONTROL

W. A. Testing Agency: A qualified independent testing agency employed and paid by the Contractor, and acceptable to the architect, will perform field quality-control testing.

X. B. Field welds will be subject to inspection.

Y. C. Testing agency will report test results promptly and in writing to Contractor and Architect.

Z. D. Remove and replace work that does not comply with specified requirements.

AA. E. Additional testing will be performed to determine compliance of corrected work with specified requirements.

REPAIRS AND PROTECTION

BB. A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces with galvanized repair paint according to ASTM A 780 and the manufacturer's instructions.

CC. B. Provide final protection and maintain conditions to ensure steel decking is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310

SECTION 05 5000 - 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.

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for countertops.

    a. Concealed Flat Brackets
    b. Semi-Concealed Brackets
    c. Exposed Brackets
    d. ADA Brackets

2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Slotted channel framing.
6. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 03 3300 "Cast-In-Place Concrete"
2. Section 04 2000 "Unit Masonry" and/or 04 2200 "Concrete Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 05 1200 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.

4. Section 06 1053 "Miscellaneous Rough Carpentry"

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, 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.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Slotted channel framing.
5. Counter and Shelf Brackets.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for countertops.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.

C. Templates/Template Drawings: Provide for anchors and bolts specified for installation under other sections.

D. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by a qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

B. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research Reports: For post-installed anchors.

1.6 QUALITY ASSURANCE

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

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.3, "Structural Welding Code - Sheet Steel"
4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer registered in the jurisdiction of the project to design components and connections of architectural elements including, but not limited to, guardrails, handrails, metal stairs, ladders, and other miscellaneous appurtenances as indicated in the Contract Documents. Submit to the Architect/Engineer, for review, signed and sealed shop drawings prepared by the contractor's engineer.

B. Thermal Movements: 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. Base engineering calculations on surface temperature of materials due to both solar heat gain and nighttime sky heat loss.

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

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 Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches.
2. Material: Galvanized steel, ASTM A653/A653M, commercial steel, Type B, with G90 coating; 0.108-inch nominal thickness.

F. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

G. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

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.

1. Provide stainless steel fasteners for fastening aluminum stainless steel ornickel silver.
2. Provide bronze fasteners for fastening bronze.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

I. Machine Screws: ASME B18.6.3

J. Lag Bolts: ASME B18.2.1

K. Wood Screws: Flat Head ASME B18.6.1

L. Plain Washers: Round, ASME B18.22.1

M. Lock Washers: Helical, spring type, ASME B18.21.1

N. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 9113 "Exterior Painting," Section 09 9123 "Interior Painting," and Section 09 9600 "High-Performance Coatings."

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

G. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

H. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

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

I. 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.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

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

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Provide bearing plates welded to beams where indicated.

D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.

E. Galvanize miscellaneous framing and supports where indicated.

F. Prime miscellaneous framing and supports with primer specified in Section 09 9600 "High-Performance Coatings" where indicated.

2.7 SUPPORTS FOR COUNTERTOPS/SHELVES

A. General:

1. Basis of Design Product(s) and Manufacturer: Subject to compliance with requirements provide the following product(s) as manufactured by A&M Hardware or comparable product(s) by another manufacturer.
2. Size: Counter brackets shall be sized as recommended by product manufacturer to accommodate counter/shelf depth, thickness, and loading. Brackets shall not extend beyond 1 inch from face of counter/shelf unless required to accommodate shelf loading or specific bracket requirements.
3. Spacing:

    a. Where attached to wood or metal studs Brackets shall not be spaced more than 48 inches apart or every other stud, whichever is less.
    b. Where attached to flat surfaces, brackets shall be spaced no more than 32 inches apart.

4. Where brackets are not symmetrical provide right and left handed brackets for flush finished exposed surface.

B. Concealed Counter Support Brackets:

1. Basis of Design Product: Concealed Flat Brackets model C or CE.

    a. Shelving: 1.0 inch width
    b. Counters: 2.0 inch width

2. Flat bracket with vertical extension, Model CE, shall be provided where wall studs or surface extend vertically above counter/shelf with sufficient hieght to accommodate vertical bracket extension without inteferring with other Work.
3. Flat bracket without vertical extension, Model C, shall be provided where a vertical extension bracket cannot be utilized.
4. Arm Lengths:

    a. 1 inch Bracket: 9, 12, 15, & 18 inches.
    b. 2 inch Bracket: 9, 12, 18, 21, & 24 inches

5. Material: Steel
6. Color: Black unless otherwise noted.

C. Semi-Concealed Brackets:

1. Basis of Design Product: Concealed Workstation Brackets model C or CE.

    a. Shelving or Counters 18 inches or less in depth: 1.0 inch

b. Counters over 18 inches in depth: 2.0 inch

2. Semi-concealed brackets with vertical extension, Model CE, shall be provided where wall studs or attachment surface extend vertically above counter/shelf with sufficient height to accommodate vertical bracket extension without interferring with other Work.
3. Semi-concealed brackets without vertical extension, Model C, shall be provided where vertical bracket cannot be utilized..
4. Arm Length:

   a. 1.0 inch Bracket: 9, 12, 15, & 18 inches
   b. 2.0 inch Bracket: 9, 12, 15, 18, 21, 24, & 30 inches

5. Material: Steel
6. Color: Black unless noted otherwise.

D. Exposed Brackets:

1. Basis of Design: Standard Workstation and Countertop Bracket.
2. Size:

   a. 18 inch Deep Counter/Worstation: Model 12 x 18

   b. 21 inch Deep Counter/Workstation: Model 21 x 21
   c. 24 inch Deep Counter/Worstation: Model 24 x24
   d. 30 inch Deep Counter/Worstation: Model 24 x 29

3. Material: Steel
4. Finish: As selected by Architect from manufacturer's full range.

E. ADA Support Bracket

1. Basis of Design Product: ADA Vanity Bracket.

2. Depth: Provide 21 inch depth or 23 inch depth bracket to accommodate counter as indicated within drawings.
3. Material: 12 gauge steel.
4. Finish:

   a. Where sides are exposed, Architect shall select finish from manufacturer's full range.
   b. Where sides are indicated to receive finished panel, provide primed finish.
   c. Where sides are indicated to receive coating/paint finish, provide primed finish.

5. Panel Attachment Hardware/Preparation:

   a. Provide skirt panel attachment clips.
   b. Where brackets are indicated to receive side panels, prepare brackets with side panel attachment holes and hardware.

F. Standards and Brackets:

1. Basis of Design Product: Subject to compliance with requirements. provide Knape & Vogt 85 Series Standards and 185 Series Brackets or comparable product by another manufacturer.
2. Standard Length: 60 inches
3. Standard Dimensions: 1-1/4 x 1/2 inches
4. Standard Thickness: 16 Ga.
5. Bracket Size: 12 inches
6. Bracket Thickness: 16 Ga.
7. Vertical Adjustment: 1 inch increments
8. Slot: Double Slot Design
9. Capacity: 680 lbs/pair
10. Finish: Manufacturer's standard Chrome/anochrome finish.

2.8 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize bearing and leveling plates.

C. Prime plates with zinc-rich primer.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with primer specified in Section 09 9600 "High-Performance Coatings."

2.10 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.11 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 09 9113 "Exterior Painting" unless primers specified in Section 09 9600 "High-Performance Coatings" are indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 09 9600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. 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.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.13 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

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. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. 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 concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLATION OF BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 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.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 5000

SECTION 06 1053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Wood blocking and nailers.
2. Plywood backing panels.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

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. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Metal framing anchors.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, 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 does not comply with requirements 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.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

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.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841. For enclosed roof framing, framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all miscellaneous carpentry unless otherwise indicated.

1. Concealed blocking.
2. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. Concealed Boards: 15 percent maximum moisture content of any of the following the following species and grades:

1. Mixed southern pine or southern pine, No. 3 grade; SPIB.
2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

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.

2.5 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.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Screws for Fastening to Metal Framing: ASTM C1002, length as recommended by screw manufacturer for material being fastened. Screw length shall be of sufficient length to penetrate and secure multiple plies to metal framing and not previous ply.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC58 ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.7 METAL FRAMING ANCHORS

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. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. USP Structural Connectors.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feeto.c.

H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1053

SECTION 06 1600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Parapet sheathing.
3. Sheathing joint-and-penetration treatment materials.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Wall sheathing.
2. Parapet sheathing.
3. Sheathing joint-and-penetration treatment materials.

B. Product Data Submittals: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

B. Field quality-control reports.

1.4 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 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, 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. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying 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.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat all plywood unless otherwise indicated.

2.5 WALL SHEATHING

A. Plywood Sheathing, Walls: , Exterior, Structural I sheathing.

1. Span Rating: Not less than 24/0.
2. Nominal Thickness: As indicated on Drawings. Where not indicated, not less than 1/2 inch.

B. Glass-Mat Gypsum Sheathing, Walls: ASTM C1177/C1177M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Certainteed; SAINT-GOBAIN.

b. Continental Building Products Inc.
c. Georgia-Pacific Gypsum LLC.
d. USG Corporation.

2. Type and Thickness: Type X, 5/8 inch thick.

C. Same as Wall Sheathing.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

2.7 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Paper-Surfaced and Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 07 9200 "Joint Sealants."

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

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. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Coordinate wall parapet sheathing 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.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 INSTALLATION OF WOOD STRUCTURAL PANEL

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:

a. Screw to cold-formed metal framing.
b. Space panels 1/8 inch apart at edges and ends.

3.3 INSTALLATION OF GYPSUM SHEATHING

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. 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. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. 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 from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. 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 from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

E. Seal sheathing joints in accordance with sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 1600

SECTION 06 2023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior trim.

1.2 DEFINITIONS

A. MDF: Medium-density fiberboard.

B. MDO: Plywood with a medium-density overlay on the face.

C. PVC: Polyvinyl chloride.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

D. Samples for Verification:

1. For each species and cut of lumber and panel products with nonfactory-applied finish, with half of exposed surface finished; 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber, mark grade stamp on end or back of each piece[, or omit grade stamp and provide certificates of grade compliance issued by grading agency].

B. Softwood Plywood: DOC PS 1.

C. Hardboard: ANSI A135.4.

2.2 INTERIOR TRIM

A. Softwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade:

a. Shall match existing exposed wood doors and trim. Where existing species cannot be determined, provide wood species closely matching existing wood grain pattern and color.

2. Maximum Moisture Content: 15 percent[with at least 85 percent of shipment at 12 percent or less].
3. Finger Jointing: Not allowed.
4. Face Surface: Surfaced (smooth).

B. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade:

a. Shall match existing exposed wood doors and trim. Where existing species cannot be determined, provide wood species closely matching existing wood grain pattern and color.

2. Maximum Moisture Content: 9 percent.
3. Finger Jointing: Not allowed.
4. Gluing for Width: Use for lumber trim wider than 6 inches.
5. Veneered Material: Use for lumber trim wider than 6 inches.
6. Face Surface: Surfaced (smooth).
7. Matching: Selected for compatible grain and color.

C. Lumber Trim for Opaque Finish (Painted Finish):

1. Species and Grade:

a. Spruce-pine-fir; NeLMA, NLGA, WCLIB, or WWPA 1 Common.

2. Maximum Moisture Content for Softwoods: 15 percent[with at least 85 percent of shipment at 12 percent or less].
3. Finger Jointing: Allowed.
4. Face Surface: Surfaced (smooth).

2.3 PANELING

A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with HPVA HP-1.

1. Face Veneer Species and Cut:

    a. Shall match existing exposed wood doors and trim. Where existing species cannot be determined, provide wood species closely matching existing wood grain pattern, cut, and color

2. Construction: Veneer core.
3. Thickness: As indicated on drawings or equal to existing paneling where not indicated.
4. Panel Size: Sizes to eliminate joints. Where impossible to eliminate joints, in sizes to reduce joints to the greatest extent.
5. Glue Bond: Type II (interior).
6. Finish: Match Architect's samples.

2.4 FABRICATION

A. Back out or kerf backs of the following members, except those with ends exposed in finished work:

1. Interior standing and running trim, except shoe and crown molds.
2. Wood-board paneling.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 INSTALLATION OF INTERIOR TRIM

A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.

1. Do not use pieces less than 24 inches long, except where necessary.
2. Stagger joints in adjacent and related standing and running trim.
3. Cope at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
4. Use scarf joints for end-to-end joints.
5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
6. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
7. Install trim after gypsum-board joint finishing operations are completed.
8. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
9. Fasten to prevent movement or warping.
10. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 INSTALLATION OF PANELING

A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels.

1. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings.
2. Install with uniform tight joints between panels.
3. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners.
4. Space fasteners and adhesive as recommended by panel manufacturer.
5. Conceal fasteners to greatest practical extent.
6. Arrange panels with grooves and joints over supports.

    a. Fasten to supports with nails of type and at spacing recommended by panel manufacturer.
    b. Use fasteners with prefinished heads matching groove color.

3.6 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements.

1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

B. Adjust joinery for uniform appearance.

3.7 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces.

B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.8 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 2023

SECTION 06 4116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

B. Related Requirements:

1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.4 DEFINITIONS

A. Surface(s): Surfaces include all faces, edges, and ends.

B. Exposed Parts- Surfaces visible when:

1. drawer fronts and doors are closed;
2. cabinets and shelving are open-type or behind clear glass doors;
3. bottoms of cabinets are 42 inches or more above finished floor;
4. tops of cabinets are below 78 inches above finished floor, or are visible from upper floor or staircase after installation;
5. portions of cabinets are visible after fixed appliances are installed;

6. front edges of cabinet body members are visible or seen through a gap of greater than 1/8 inch with doors and drawers closed.

C. Semi-Exposed Parts- Surfaces visible when:

1. drawers/doors are int he open position;
2. bottoms of cabinets are between 30 inches and up to 42 inches above finshed floor;
3. shelving behind doors.

D. Concelaed Surfaces- Surfaces are concealed when:

1. surfaces are not visible after installation;
2. bottoms of cabinets are less than 30 incehs above finished floor;
3. tops of cabinets are over 78 incehs above finsih floor and are not visible from an upper level;
4. stretchers, blocking, and/or components are concealed by drawers.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include high-pressure decorative laminate adhesive for bonding plastic laminate and cabinet hardware and accessories.

B. Sustainable Design Submittals:

1. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.

C. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

D. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.

E. Samples for Initial Selection: For each type of exposed finish.

1. Plastic laminates.

F. Samples for Verification: For the following:

1. Plastic Laminates: 12 by 12 inches, for each type, color, pattern, and surface finish required.

a. Provide one sample applied to core material with specified edge material applied to one edge.

2. Wood Grain Plastic Laminates: 15 by 30 inches for each type, pattern and surface finish required.

a. Provide one sample applied to core material and specified edge material applied to one edge.

3. Corner Pieces:

a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
b. Miter joints for standing trim.

4. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Certificates: For the following:

1. Composite wood products.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

D. Field quality-control reports.

1.8 QUALITY ASSURANCE

A. Fabricator's/Manufacturer's Qualifications: 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.

B. Installer Qualifications: Manufacturer of products.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups of typical architectural cabinets as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

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

1.10 FIELD CONDITIONS

A. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents may contain requirements that are more stringent than the referenced quality standard. Comply with the more stringent requirements of the Contract Documents where indicated in addition to those of the referenced quality standard.

B. Architectural Woodwork Standards Grade: Custom.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Abet Laminati Inc.
b. Formica Corporation.
c. Lamin-Art, Inc.
d. Pionite; a Panolam Industries International, Inc. brand.
e. Wilsonart LLC.

F. Laminate Cladding for Exposed Surfaces: Core- MDF

1. Horizontal Surfaces: Grade HGS.
2. Vertical Surfaces: Grade HGS.
3. Edges: Grade HGS.

G. Materials for Semiexposed Surfaces: Core- MDF

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
2. Drawer Sides and Backs: Solid-hardwood lumber.

a. Maple

3. Drawer Bottoms: Hardwood plywood.

a. Maple Veneer

H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued dovetail joints.

J. 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 selected by Architect from laminate manufacturer's full range in the following categories:

a. Solid Colors, both gloss and matte finishes
b. Solid colors with core same color as surface both gloss and matte finishes
c. Wood grain, both gloss and matte finishes
d. Patterns, both gloss and matte finishes

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Composite Wood Products: Products shall be made without urea formaldehyde.
2. Medium-Density Fiberboard (MDF): ANSI A208.2, MD.
3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
4. Thermoset Decorative Panels: Are not permitted.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials 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. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.

C. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E84.

2.4 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 7100 "Door Hardware."

B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 135 degrees of opening, self-closing.

C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

E. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04102; with shelf brackets, B04112.

F. Shelf Rests: ANSI/BHMA A156.9, B04013; [metal] [plastic] [two-pin plastic with shelf hold-down clip].

G. Drawer Slides: ANSI/BHMA A156.9.

1. Grade 1: Side mounted and extending under bottom edge of drawer.

a. Type: Full extension.
b. Material: Zinc-plated steel with polymer rollers.

2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full -extension type; zinc-plated-steel ball-bearing slides.
3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
6. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.

H. Door Locks: ANSI/BHMA A156.11, E07121.

I. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

J. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: Black Insert color.

K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.

1. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.

L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Do not use adhesives that contain urea formaldehyde.

D. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 FABRICATION

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom grade interior woodwork complying with referenced quality standards Architectural Woodwork Institute (AWI).

B. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

1. Cabinets and countertops displaying delamination and shrinking as a result of conditioning shall be removed and replaced.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings 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.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 06 4116

SECTION 06 6400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Crane Composites, Inc., Varietex Linen Texture or comparable product by one of the following:

    a. Crane Composites, Inc.
    b. Glasteel.
    c. Marlite.
    d. Newcourt, Inc.
    e. Nudo Products, Inc.
    f. Parkland Plastics, Inc.

2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 450 or less.

3. Nominal Thickness: Not less than 0.12 inch.
4. Surface Finish: As selected by Architect from manufacturer's full range.
5. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

    1. Color: Match panels.

B. Adhesive: As recommended by plastic paneling manufacturer.

C. Sealant: Mildew-resistant, single-component, neutral-curing or acid-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 9200 "Joint Sealants."

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. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.

1. Mark plumb lines on substrate at panel joint locations for accurate installation.
2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive. Do not fasten through panels.

D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 6400

SECTION 07 1326 - SELF-ADHERING SHEET WATERPROOFING

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 Department of Public Works Design Manual dated January 2000 and as amended.

C. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated July, 2021 and as amended.

1.2 SUMMARY

A. Section Includes:

1. Modified bituminous sheet waterproofing.
2. Blindside sheet waterproofing.
3. Protection course.
4. Molded-sheet drainage panels.

B. Related Requirements:

1. Section 033000 "Cast in Place Concrete" for exterior-wall waterproofing.

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. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

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

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 a 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Waterproofing System: Obtain waterproofing materials and protection course from single source from single manufacturer.

B. Approved material is Mel-Rol from W.R. Meadows, including primer and protection course.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet Waterproofing: Minimum 60-milnominal thickness, self-adhering sheet consisting of 56 milsof rubberized asphalt laminated on one side to a 4-mil-thick, polyethylene-film reinforcement, and with release liner on adhesive side formulated for application with primer.

1. Physical Properties:

    a. Tensile Strength, Membrane: 250 psiminimum; 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-inchmovement; ASTM C836/C836M.
    e. Puncture Resistance: 40 lbfminimum; 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 permmaximum; ASTM E96/E96M, Water Method.

2. Physical Properties:

    a. Pliability: No cracks when bent 180 degrees over a 1-inchmandrel at minus 25 deg F; ASTM D146/D146M.
    b. Puncture Resistance: [40 lbf] [100 lbf] minimum; ASTM E154/E154M.
    c. Water Vapor Permeance: 0.05 permmaximum; ASTM E96/E96M, Water Method.

3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

B. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

C. Primer: Liquid primer recommended for substrate by sheet waterproofing material manufacturer.

D. Protection Course, Asphaltic: ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:

1. Thickness: Nominal 1/8 inchfor vertical applications; 1/4 inchelsewhere.
2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.

E. Protection Course, Extruded-Polystyrene Board Insulation, Faced: Fan folded, faced on one side with plastic film, nominal thickness 1/4 inch, with compressive strength of not less than 8 psi per ASTM D1621, and maximum water absorption by volume of 0.6 percent per ASTM C272/C272M.

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 application.

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. Corners: Prepare, prime, and treat inside and outside corners in accordance with manufacturer's instructions.

H. 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.

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 protection course with butted joints over waterproofing membrane.

1. Molded-sheet drainage panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

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.

3.5 INSTALLATION OF INSULATION DRAINAGE PANELS

A. Install insulation drainage panels over waterproofed surfaces. Cut and fit to within 3/4 inch of projections and penetrations.

B. Ensure that drainage channels are aligned and free of obstructions.

C. On vertical surfaces, set insulation drainage panels in adhesive or tape applied according to manufacturer's written instructions.

3.6 PROTECTION, REPAIR, AND CLEANING

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed insulation 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 1326

SECTION 07 1900 - WATER REPELLENTS

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 clear film-forming water-repellent treatments for the following vertical and non-traffic horizontal surfaces:

1. Unit Masonry

B. Related Sections:

1. Section 04 2000 "Unit Masonry" for integral water-repellent admixture for unit masonry assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Water Absorption: Minimum 80 percent reduction of water absorption after 24 hours in comparison of treated and untreated specimens.

1. Concrete Masonry Units: ASTM C 140.
2. Clay Brick: ASTM C 67.

1.4 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Installed water repellents shall comply with performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard substrate assemblies by a qualified testing agency.

1.5 ACTION SUBMITTALS

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

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's standard colors.

3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.
4. Printout of current "MPI Approved Products List" for each product category specified in Part 2 that specifies water repellents approved by MPI, with the proposed product highlighted.

B. Samples: For each type and color of water repellent and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of water repellent, from manufacturer.

B. Warranty: Special warranty specified in this Section.

1.7 QUALITY ASSURANCE

A. Mockups: Apply water repellent to each type of substrate required.

1. Locate each test application as directed by Architect.
2. Size: 10 sq. ft..
3. Final approval by Architect of water-repellent application will be from test applications.

1.8 PROJECT CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.
2. Building has been closed in for not less than 30 days before treating wall assemblies.
3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
5. Rain or snow is not predicted within 24 hours.
6. Not less than 24 hours have passed since surfaces were last wet.
7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which Applicator agree(s) to repair or replace materials that fail to maintain water repellency due to materials and/or workmanship as specified within specified warranty period. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrates, and new substrate cracks in excess of 1/16 inch wide, fire, vandalism, or abuse by maintenance equipment.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

A. Proprietary-Blend, Penetrating Water Repellent: Clear, consisting of one or several different resins (silanes or siloxanes or acrylics), polymers, stearates, or oils plus other compounds or products of components; and with 400 g/L or less of VOCs.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals, LLC; Enviroseal 20.
b. PROSOCO, Inc.; Weatherseal H40.
c. Diedrich Technologies inc.; Diedrich 303 WB
d. Sonneborn Building Products; White Roc 10 WB
e. Euclid Chemical; Chemstop WB Heavy Duty
f. Diedrich Technologies, Inc.; Diedrich 303
g. Harris Specialty Chemicals, Inc. Enviroseal Silane 20.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in number of representative locations recommended by manufacturer and by method recommended by manufacturer.
2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.
3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.

4. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions and as follows:

1. Cast-in-Place Concrete and Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents .

B. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

C. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

D. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using 15 psi- pressure spray with a fan-type spray nozzle to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

1. Cast Stone: At Contractor's option, first application of water repellent on units may be completed before installing them. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:

1. Contractor shall engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect. .

B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.

1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
2. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 1900

SECTION 07 2100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.
4. Mineral-wool board insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.
4. Mineral-wool board insulation.

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 until just 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 Board Insulation, Type VII Underslab Insulation: ASTM C578, Type VII, 60-psi minimum compressive strength.

1. Basis of Design Product: Subject to compliance with requirements, provide Owens Corning Foamular NGX 600 XPS Insulation or comparable product by another manufacturer.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
5. Basis of Design Product: Subject to compliance with requirements, provide Owens Corning Foamular NGX 600 XPS Insulation or comparable product by another manufacturer.

B. Extruded Polystyrene Board Insulation, Type V Cavity Wall Insulation: ASTM C578, Type V, 100-psi minimum compressive strength.

1. Basis of Design Product: Subject to compliance with requirements, provide Owens Corning Foamular NGX 1000 XPS Insulation or comparable product by another manufacturer.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Polyisocyanurate Board Insulation, Glass-Fiber-Mat Faced Roof Insulation- Base Layers: ASTM C1289, glass-fiber-mat faced, Type II, Class 2.

1. Basis of Design Product: Subject to compliance with requirements, provide Carlisle SecureShield insulation board or comparable product by another manufacturer.
2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

B. Polyisocyanurate Board Insulation, Glass-Fiber-Board Faced Composite Roof Insulation- Top Layer: ASTM C1289, composite board faced, Type II, Class 4.

1. Basis of Design Product: Subject to compliance with requirements, provide Carlisle Coverboard SecureShield HD insulation board or comparable product by another manufacturer.

2.3 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced : ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. CertainTeed Corporation.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Knauf Insulation.
    d. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

B. Glass-Fiber Blanket Insulation, Polypropylene-Scrim-Kraft Faced : ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. CertainTeed Corporation.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Owens Corning.

2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.4 MINERAL-WOOL BOARD INSULATION

A. Mineral Wool Board Insulation, Type IVB Faced Exterior Insulation for Rain Screen Applications: ASTM C612, Type IVB; faced on one side with a black mineral fleece facing.

1. Basis of Design Product: Subject to compliance with requirements, provide Cavityrock as manufactured by Rockwool or comparable product by another manufacturer.

a. Monolithic Density: 4.3 lb/cu. ft.
b. Denisty: 6.2 lb/ cu. ft.
c. Flame Spread Index: Not more than 15 when tested in accordance with ASTM E84
d. Smoke Developed Index: Not more than zero when tested in accordance with ASTM E84
e. Labeling: Provide identification of mark indicating R value of each piece of insulation 12 inches and wider in width.

2.5 ACCESSORIES

A. 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.

B. 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 SLAB INSULATION

A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.

1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

B. Mineral-Wool Board Insulation: Install insulation fasteners 4 inches from each corner of board insulation, at center of board, and as recommended by manufacturer.

1. Fit courses of insulation between obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
6. For wood-framed construction, install blankets according to ASTM C1320 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.

7. 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.
    b. Interior Walls: Set units with facing placed as indicated on Drawings toward areas of high humidity.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

    a. Provide FSK insulation or other faced insulation complying with flame spread requirements and smoke development requirements of the AHJ.

2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. 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 2100

SECTION 07 2163 - FLUID-APPLIED INSULATIVE COATING

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. Spray-applied insulative coatings; including primer, insulative coatings and topcoat for:

a. Steel penetrating the exterior envelope, from 18 inches inside the face of metal framing to a minimum of 18 inches outside the face of the wall.

1.3 REFERENCES

A. American Institute of Steel Construction (AISC)

1. AISC 303-05 Section 10 - Erection and storage of coated material during shipment and site handling shall be protected to minimize field touch up.

B. American Society of Testing and Materials (ASTM)

1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus
2. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
3. ASTM C1057 - Standard Practice for Determination of Skin Contact Temperature from Heated Surfaces Using a Mathematical Model and Thermesthesiometer.
4. ASTM D870 - Standard Practice for Testing Water Resistance of Coatings Using Water Immersion.
5. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
6. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
7. ASTM D4585 - Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation.
8. ASTM D4587 - Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.
9. ASTM D4624/ISO 4624 - Standard Test Method for Bond Strength

10. ASTM D5894 - Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet).
11. ASTM D638 - Standard Test Method for Tensile Strength
12. ASTM D695 - Standard Test Method for Compressive Strength
13. ASTM D790 - Standard Test Method for Flexural Strength
14. ASTM D2240 - Standard Test Method for Determining Durometer Hardness
15. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
16. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

C. Association of the American Walls and Ceilings Industries (AWCI)

D. Underwriters Laboratory (UL):

1. UL 263: Standard for Fire Tests of Building Construction and Materials.

E. The Society of Protective Coatings (SSPC)

1. SSPC-SP6: Commercial Blast Cleaning Standard
2. SSPC-PA1: Shop, Field, and Maintenance Painting of Steel.
3. SSPC-PA2: Procedure for Determining Conformance to Dry Coating Thickness Requirements.

1.4 SYSTEM DESCRIPTION

A. The liquid applied thermal break acrylic material shall be applied at the required thickness specified by the manufacturer in order to mitigate thermal bridging. In no case shall the K-value of the liquid applied thermal break be more than 0.040 W/mK.

1.5 SUBMITTALS

A. Product Data: Submit product data including manufacturers technical data indicating product performance characteristics, performance and limitation criteria.

B. Manufacturer's Instructions: Submit manufacturer written installation instructions.

C. Applicator Qualifications: Submit applicators current certification as a manufacturer trained applicator.

1.6 QUALITY ASSURANCE

A. Manufacturer:

1. Company specializing in manufacturing product in this section with a minimum of 2 years documented experience in manufacturing insulative technology.
2. Applicator: Company specializing in applying the work of this section with documented experience and trained by the manufacturer.
3. Fluid Applied Thermal Break Acrylic system shall be the complete system from a sole source consisting of primer, acrylic thermal break material and topcoat. All materials shall be LEED 2009 compliant.

B. Mock-up:

1. Minimum thirty days prior to application in any area, provide mock-up Samples of thermal break materials in accordance with the following requirements:

   a. Provide minimum two square feet on representative substrate, where directed by the Architect, for each different thickness and finish of required for the work.
   b. Provide mock-up areas that comply with thickness, density application, finish texture, and color.
   c. Inspect mock-up areas within one hour of application for variance due to shrinkage, temperature, and humidity.
   d. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary to meet required installation, finish, and color requirements.
   e. Continue to provide mock-up areas until acceptable areas are produced.
   f. Acceptable areas shall constitute standard of acceptance for method of application, thickness, finish texture, and color requirements, for fluid applied thermal break material applications.

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials in manufacturers' original, sealed, undamaged container with identification label intact. Packaged materials shall bear the appropriate labels, seals.

B. Storage: Materials shall be stored in strict accordance with manufacturers documented instructions.

C. Documentation: All batch number, product identification and quantities shall be recorded on appropriate QC documents. A copy of the transport document and manufacturers conformance certificate shall be attached to the material delivery on site.

1.8 PROJECT/SITE CONDITIONS

A. Project Environmental Requirements: Substrate and air temperature shall be in accordance with the manufacturers' requirements.

1. Protect work area from windblown dust and rain. Protect adjacent areas from over spray of material.
2. Provide ventilation in areas to receive work of this section during application and minimum 24 hours after application.

B. Temperature and Humidity Requirements: Maintain air temperature and relative humidity in areas where products will be applied for a time period before during and after application as recommended by manufacturer.

1. Do not apply Fluid Applied Acrylic Thermal Break when temperature of substrate and/or surrounding ambient air temperature is below 45° F. Temporary protection and heat shall be maintained at this minimum temperature for 24 hours before, during and 24 hours after material application.
2. Steel substrate temperature shall be a minimum of 5° F (3° C) above the dew point of the surrounding air for a period of 24 hours prior, during the application of the material and 24 hour cure period.
3. If necessary for job schedule, the General Contractor shall provide enclosures and heat to maintain proper temperatures and humidity levels in the application areas.
4. The relative humidity of the application area shall not exceed a maximum of 85% 24 hours prior, during and 24 hours after the application of the material. The relative humidity shall not exceed 75% throughout the application and curing of the decorative top coat finish.

PART 2 - PRODUCTS

2.1 FLUID APPLIED INSULATION COATING GENERAL

A. Materials Compatibility:

1. Provide shop and field 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.
2. Provide products of same manufacturer for each coat in a coating system.

2.2 MANUFACTURERS

A. Basis of Design Manufacturer: Subject to compliance with requirements, products shall be provided by Tnemec Company Incorporated or comparable products by another manufacturer.

B. Materials specified herein shall not preclude consideration of equivalent or superior materials. Suggested equivalent materials or other substitutions shall be submitted to Architect for consideration in compliance with substitution procedures set forth in this Project Manual and include the following:

1. Requests for substitution shall include evidence of satisfactory past performance in similar environment.
2. Substitutions will not be considered for any insulation coating with a K-value greater than 40 mW/mK
3. Manufacturer's certified test reports showing the substitute product(s) performance as outlined in Paragraph 2.15 shall be submitted.

C. Bidders desiring to use coatings other than those specified shall submit those with their proposal based on the specified materials, together with the information required in Paragraph 1.5 above, and indicate the sum which will be added to or deducted from the base bid should alternate materials be accepted.

2.3 PRIMERS

A. Water-Based Cementitious Epoxy Primer for Galvanized Steel:

1. Tnemec Series 1224 Epoxoline WB

a. VOC Content: 1 gram/liter
b. Color: 1288 Off-White
c. Requirements:

1) Abrasion (ASTM D4060): No more than 149 mg loss after 1,000 cycles.
2) Adhesion to Steel (ASTM D4541): No less than 1,989 psi after 10 freeze/thaw cycles.
3) Humidity Resistance (ASTM D4585): No blistering, cracking, rusting, or delamination after 2,000 hours.
4) CDPH Compliant: Passes the California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1-2010 (also known as Section 01350).

B. Mio-Zinc Filled Aromatic Polyurethane Primer for Ferrous Steel:

1. Tnemec Series 394-0250 PerimePrime®

a. VOC Content: 246 grams/liter
b. Color: 0250 Greenish-Gray
c. Requirements:

1) Adhesion to Steel (ASTM D4541): No less than 1,150 psi.
2) Fire Testing (UL 263, ASTM E119): Any UL Classified spray-applied fire resistive materials having a maximum average density of 19.5 pcf. Including W.R. Grace Monokote MK-6/HY and Isolatek (Cafco) Blaze-Shield II (Type II).

3) Salt Fog Corrosion (ASTM B117): No cracking or delamination of film. No more than 1/64" rust creepage at scribe and no more than 3% rusting on plane after 10,250 hours exposure.
4) Slip Coefficient & Tension Creep: Meets AISC requirements of a Class B surface with a mean slip coefficient no less than 0.57.
5) CDPH Compliant: Passes the California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1-2010 (also known as Section 01350).

2.4 THERMAL INSULATIVE COATING

A. Fluid-Applied Acrylic Insulative Coating

1. Tnemec Series 971 Aerolon Acrylic

a. VOC Content: 1.9 grams/liter
b. Solids by Volume: 76 percent.
c. Colors: 1278 Insulation Yellow
d. Requirements:

1) Abrasion (ASTM D4060): No more than 50.2 mg loss after 1,000 cycles.
2) Cyclic Salt Fog/UV Exposure (ASTM D5894): No blistering, cracking, rusting or delamination of film after 5,000 hours.
3) Humidity Resistance (ASTM D4585): No blistering, cracking, rusting, or delamination after 2,000 hours.
4) Immersion (ASTM D870): No blistering, cracking, rusting, or delamination after six months continuous tap water immersion.
5) Surface Burning Characteristics (ASTM E84): Class A
6) Thermal Conductivity (ASTM C518): No greater than 0.0356 W/m-°K or 0.2468 BTU-in/ft^2-hr-°F.
7) NORSOK M-501 ISO 20340: Passed 25 cycles.
8) CDPH Compliant: Passes the California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1-2010 (also known as Section 01350).

2.5 TOPCOAT

A. Aliphatic Acrylic Polyurethane

1. Tnemec Series 1095 Endura-Shield®

a. VOC Content: 87 grams/liter.
b. Colors: Refer to Tnemec Color Guide.
c. Requirements:

1) Adhesion (ASTM D4541): No less than 1,912 psi.
2) Cyclic Salt Fog/UV Exposure (ASTM D 5894): No blistering, cracking, rusting or delamination of film after 672 hours of exposure.
3) Prohesion (ASTM G 85): No blistering, cracking, rusting or delamination of film after 1,000 hours exposure.
4) Salt Spray (Fog) (ASTM B 117): No blistering, cracking, rusting or delamination of film after 1,000 hours exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. All surfaces to receive the specified Tnemec Series 971 Aerolon® shall follow the manufacturer's printed instructions and be clean, dry and free of oil, grease, loose mill scale, dirt, dust or other foreign substances which would impair bond of the material to the substrate.

D. Other corrections of the surfaces to receive the Fluid Applied Insulation Coating material shall be the responsibility of the Contractor, at no additional cost to the Owner.

E. Application of the primer, Series 971 Aerolon®, and topcoat shall not commence until the contractor, applicator and inspector have examined the surfaces to receive the primer and determined the surfaces are acceptable to receive the primer and Aerolon®. Commencement of application means acceptance of substrate.

F. Verify that substrate and workspace temperature and humidity conditions are in accordance with manufacturers recommendations.

3.2 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer's instructions.

B. Provide masking, drop cloths or other suitable coverings to prevent overspray onto surfaces not intended to be coated with thermal break coating.

C. Weld spatter and defects shall be ground smooth prior to commencement of primer and fluid applied thermal break material.

D. Primer shall not be applied to prepared substrate until the area has been adequately vented to remove all airborne dust. Prior to the application of any coating material, the blast products, dust and debris shall be removed by vacuuming.

E. Steel Substrates: Remove rust and loose mill scale.

1. Fabrication defects:

a. Correct steel and fabrication defects revealed by surface preparation.
b. Remove weld spatter and slag.
c. Round sharp edges and corners of welds to a smooth contour.
d. Smooth weld undercuts and recesses.
e. Grind down porous welds to pinhole-free metal.
f. Remove weld flux from surface.

2. Ensure surfaces are dry.
3. Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with a minimum prep of SSPC SP3 Power Tool Cleaning , unless otherwise specified.

F. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.

1. Shop Primer: Prepare shop primer to receive field coat in accordance with manufacturer's instructions.

3.3 APPLICATION

A. Apply coatings in accordance with manufacturer's instructions.

1. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
2. Keep containers closed when not in use to avoid contamination.
3. Do not use mixed coatings beyond pot life limits.
4. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

B. Uniformly apply coatings at spreading rate required to achieve specified DFT.

C. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

D. Apply primer at thickness recommended by manufacturer.

E. Apply Series 971 Aerolon® Thermal Insulative Coating as specified in Section 3.8 Coating Schedule.

F. Apply topcoat at thickness recommended by the manufacturer.

G. Final Dry Film Thickness (DFT) shall be measured with a dry film thickness gauge.

H. The steel deck is not to be sprayed unless otherwise indicated.

3.4 REPAIR

A. Materials and Surfaces Not Scheduled to Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: All patching and repair to material, due to damage by other trades, shall be performed under this section and paid for by the trade responsible for the damage. Patching shall be performed by applicators certified by the manufacturer and applied in accordance with the manufacturer application instructions.

C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.5 FIELD QUALITY CONTROL

A. The Owner will engage an independent testing laboratory inspect and verify the application of material in accordance with the provisions Tnemec Company.

1. Material inspection and testing shall be performed 24 hours after completion of final application coat.
2. The results of the above tests shall be made available to all parties at the completion of each pre-designated area and approval.
3. In-place material not in compliance with the specified thickness requirements shall be corrected prior to final acceptance.

B. The dry film thickness (DFT) of the applied material shall be measured with a non-destructive coating thickness gage after material has completely cured. All measurements shall be documented in writing and furnished to the Owner.

C. Manufacturer's Technical Services: Coordinate with coating manufacturer's technical service department or independent sales representative for current technical data and instructions.

3.6 CLEANING AND PROTECTION

A. Remove overspray materials from surfaces not required to be thermally protected.

B. Protect surfaces of coating systems from damage during construction.

C. Touch-up, or repair damaged products before Substantial Completion.

3.7 FLUID APPLIED INSULATION COATING SCHEDULE

A. Steel Members Penetrating Exterior Building Envelope.

1. Fluid Applied Thermal Break System, HSS/Tube Steel:

   a. Surface Preparation Galvanized: SSPC-SP16
   b. Surface Preparation Ferrous: Minimum SSPC-SP3
   c. Prime Coat (Shop or Field) Galvanized: Series 1224 Epoxoline WB, DFT of 4.0 to 6.0 mils per coat.
   d. Prime Coat (Shop or Field) Ferrous: Series 394-0250 PerimePrime, DFT of 2.5 to 3.5 mils per coat.
   e. Thermal Break Coats (Shop or Field) -: Series 971 Aerolon Acrylic, DFT of 40.0 to 45.0 mils per coat. Total thickness of Series 971: 120 to 135 mils.
   f. Finish Coat (Optional): Series 1028 Enduratone, DFT of 2.0 to 3.0 mils per coat.

2. Fluid Applied Thermal Break System, Wide Flange and Masonry Ledge:

   a. Surface Preparation Galvanized: SSPC-SP16
   b. Surface Preparation Ferrous: Minimum SSPC-SP3
   c. Prime Coat (Shop or Field) Galvanized: Series 1224 Epoxoline WB, DFT of 4.0 to 6.0 mils per coat.
   d. Prime Coat (Shop or Field) Ferrous: Series 394-0250 PerimePrime, DFT of 2.5 to 3.5 mils per coat.
   e. Thermal Break Coats (Shop or Field) -: Series 971 Aerolon Acrylic, DFT of 40.0 to 50.0 mils per coat. Total thickness of Series 971: 80 to 100 mils.
   f. Finish Coat (Optional): Series 1028 Enduratone, DFT of 2.0 to 3.0 mils per coat.

END OF SECTION 07 2163

SECTION 07 2726 - FLUID-APPLIED MEMBRANE AIR 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. Vapor-permeable, fluid-applied air barriers.

B. Related Requirements:

1. Section 06 1600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. 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.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 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 air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate 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.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

1.7 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.

B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.

1. Build integrated mockups of exterior wall assembly , 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

a. Include junction with roofing membrane, building corner condition,and foundation wall intersection.

b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

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.

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 and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. 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 0.0002 cfm/sq. ft. of surface area at 75 Pa, when tested according to ASTM E 2357.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils over smooth, void-free substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

a. 3M Industrial Adhesives and Tapes Division; 3M Liquid Air Barrier 2085VP.
b. DuPont Building Innovations: E. I. du Pont de Nemours and Company; DuPont Tyvek Fluid Applied WB.
c. Rubber Polymer Corporation, Inc.; Rub-R-Wall Airtight VP.
d. Sto Corp; StoGuard AirSeal.
e. TK Products; TK-Airmax 2104 Vapor Permeable.
f. W.R. Meadows, Inc; Air-Shield LMP.

2. Physical and Performance Properties:

a. Vapor Permeance: Minimum 22 perms; ASTM E 96/E 96M, Desiccant Method, Procedure A.
b. Ultimate Elongation: Minimum 320 percent; ASTM D 412, Die C.
c. Adhesion to Substrate: Minimum 25 lbf/sq in when tested according to ASTM D 4541.
d. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

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.

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. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D 4263.
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 material.

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 isolation joints expansion 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 according to 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 preformed silicone extrusion 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.
2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

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- wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings 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 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 according to 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. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.

1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.

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. 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, if applicable.
8. 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.

9. Termination mastic has been applied on cut edges.
10. Strips and transition strips have 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.

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 2726

SECTION 07 5216 - STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Styrene-butadiene-styrene (SBS)-modified bituminous membrane roof system.
2. Roofing membrane sheet materials.
3. Base sheet materials.
4. Interply sheets.
5. Styrene-butadiene-styrene (SBS)-modified bituminous cap sheet.
6. Base flashing sheet materials.
7. Asphalt materials.
8. Accessory roofing materials.
9. Substrate board.
10. Vapor retarder.
11. Roof insulation.
12. Insulation accessories and cover board.
13. Walkways.

B. Section includes the installation of sound-absorbing insulation strips in ribs of roof deck. Sound-absorbing insulation strips are furnished under Section 05 3100 "Steel Decking."

C. Related Requirements:

1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 6200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 07 7100 "Roof Specialties" for premanufactured metal copings roof edge fasciae roof edge flashings.
4. Section 07 7129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
5. Section 07 9200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

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

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

B. Shop Drawings: Include plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation, including slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
6. Crickets, saddles, and tapered edge strips, including slopes.
7. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
8. Tie-in with adjoining air barrier.

C. Samples for Verification: For the following products:

1. Cap Sheet: Samples of manufacturer's standard colors for selection by Architect.

2. Flashing Sheet: Samples of manufacturer's standard colors for selection by Architect.
3. Walkway Pads or Rolls: Samples of manufacturer's standard colors for selection by Architect.

D. Wind Uplift Resistance Submittal: For roofing system indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturer and testing agency.

B. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

    a. Submit evidence of complying with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Product Test Reports: For roof membrane and insulation, tests performed by a qualified testing agency, indicating compliance with specified requirements.

D. Evaluation Reports: For components of membrane roofing system, from ICC-ES.

E. Field Test Reports:

1. Concrete internal relative humidity test reports.
2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

F. Field quality-control reports.

G. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.
2. Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

1. Protect stored liquid material from direct sunlight.
2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.

1. Store in a dry location.
2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, vapor retarder, substrate board, roof pavers, and other components of roofing system.
2. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight.

1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:

1. Zone 1 (Roof Area Field): 89 psf.
2. Zone 2 (Roof Area Perimeter): 113 psf.

    a. Location: From roof edge to 0.6H inside roof edge.

3. Zone 3 (Roof Area Corners): 149 psf.

    a. Location: 0.6H in each direction from each building corner.

D. Solar Reflectance Index (SRI): Three-year-aged SRI not less than 64 or initial SRI not less than 82 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

E. Energy Performance: Roofing system to have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested in accordance with ANSI/CRRC S100.

F. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency.

1. Identify products with appropriate markings of applicable testing agency.

G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.

1. Identify products with appropriate markings of applicable testing agency.

2.2 MANUFACTURERS

A. Styrene-Butadiene-Styrene (SBS)-Modified Bituminous Membrane Roof System: See the following articles for individual roof materials required.

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. Bitec, Inc.
b. Firestone Building Products. Basis of Design
c. GAF.
d. Henry Company.
e. IKO Industries Inc.
f. Johns Manville; a Berkshire Hathaway company.
g. Polyglass U.S.A., Inc.
h. Soprema, Inc.
i. Tremco Incorporated.

2.3 SOURCE LIMITATIONS

A. Obtain components for roof system from roof membrane manufacturer or manufacturer approved by roof membrane manufacturer.

2.4 BASE SHEET MATERIALS

A. SBS-Modified Bitumen Type I, Glass-Fiber-Mat Base Sheet, Torch: ASTM D6163/D6163M, Type I, Grade S, SBS-modified asphalt sheet, reinforced with glass fibers, smooth surfaced, suitable for torch application method.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Certainteed; SAINT-GOBAIN.
b. Firestone Building Products. Basis of Design
c. GAF.
d. IKO Industries Inc.

e. Johns Manville; a Berkshire Hathaway company.
f. Polyglass U.S.A., Inc.
g. Siplast.
h. Soprema, Inc.

2.5 STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS CAP SHEET

A. SBS-Modified Bitumen Type II, Polyester-Mat, Granule-Surfaced Cap Sheet, Torch: ASTM D6164/D6164M, Type II, Grade G, SBS-modified asphalt sheet, reinforced with polyester fabric, suitable for torch application method.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Certainteed; SAINT-GOBAIN.
b. Firestone Building Products. Basis of Design
c. IKO Industries Inc.
d. Johns Manville; a Berkshire Hathaway company.
e. Polyglass U.S.A., Inc.
f. Soprema, Inc.

2. Granule Color: White.

2.6 BASE FLASHING SHEET MATERIALS

A. Liquid Flashing System: Roof membrane manufacturer's standard one- or two-part moisture curing resin with low solvent content, consisting of a primer, flashing cement, and scrim.

2.7 ASPHALT MATERIALS

A. Asphalt Primer: ASTM D41/D41M.

B. Roofing Asphalt: ASTM D312/D312M, Type III or IV as recommended by roofing system manufacturer for application.

2.8 ACCESSORY ROOFING MATERIALS

A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

C. Roof Vents: As recommended by roof membrane manufacturer.

1. Size: Not less than 4-inch diameter.

D. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft..

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

F. Cold-Applied Trichloroethylene Asphalt Adhesive: ASTM D3019, Type III, roof membrane manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing membrane base flashings.

G. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required by roofing system manufacturer for application.

H. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.

I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

J. Roofing Granules: Ceramic-coated Slate roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98 percent of mass retained on No. 40 sieve; color to match roof membrane.

K. Aggregate Surfacing: ASTM D1863/D1863M, No. 6 or No. 67, clean, dry, opaque, water-worn gravel or crushed stone, free of sharp edges crushed slag, free of sharp edges.

L. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.9 SUBSTRATE BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert value> percent.

B. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Certainteed; SAINT-GOBAIN.
b. Georgia-Pacific Gypsum LLC.
c. National Gypsum Company.
d. USG Corporation.

2. Thickness: Type X, 5/8 inch.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.10 ROOF INSULATION

A. General: Preformed roof insulation boards, manufactured or approved by roof membrane manufacturer, approved for use in FM Approvals' RoofNav listed roofing assemblies.

B. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other surface.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Atlas Roofing Corporation - Molded Polystyrene.
b. Atlas Roofing Corporation - Polyiso.
c. Certainteed; SAINT-GOBAIN.
d. Firestone Building Products. Basis of Design
e. GAF.
f. Homasote Company.
g. Hunter Panels.
h. Insulfoam; Carlisle Construction Materials Company.
i. Johns Manville; a Berkshire Hathaway company.

2. Facer Type IV cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch thick.
3. Size: 48 by 96 inches.

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch.
3. Slope:

a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.11 INSULATION ACCESSORIES AND COVER BOARD

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.

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 roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 3100 "Steel Decking."
4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.
5. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions.

1. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

1. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Perform fastener-pullout tests according to roof system manufacturer's recommendations.

1. Submit test result within 24 hours of performing tests.

a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast.

1. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified in Section 07 2726 "Fluid-Applied Membrane Air Barriers."

D. Asphalt Heating:

1. Heat asphalt to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before application.

a. For cap sheets, heat asphalt according to cap sheet manufacturer's recommendations.

2. Circulate asphalt during heating.
3. Do not raise asphalt temperature above equiviscous temperature range more than one hour before time of application.

a. For cap sheets, comply with cap sheet manufacturer's recommendations.

4. Do not exceed asphalt manufacturer's recommended temperature limits during asphalt heating.
5. Do not heat asphalt within 25 deg F of flash point.
6. Discard asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
7. Apply hot roofing asphalt within plus or minus 25 deg F of equiviscous temperature.

a. For cap sheets, comply with cap sheet manufacturer's recommendations.

E. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 INSTALLATION OF SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.

    a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.
5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.5 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows end joints staggered not less than 12 inches in adjacent rows and with long joints continuous at right angle to flutes of decking.

    a. Locate end joints over crests of decking.
    b. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
    c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    e. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus 24 inches.

1) Trim insulation, so that water flow is unrestricted.

f. Fill gaps exceeding 1/4 inch with insulation.
g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
h. Mechanically attach base layer of insulation and substrate board using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.

1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install upper layers of insulation and tapered insulation, with joints of each layer offset not less than 12 inches from previous layer of insulation.

a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
e. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus 24 inches.
f. Trim insulation, so that water flow is unrestricted.
g. Fill gaps exceeding 1/4 inch with insulation.
h. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
i. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines, with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

    a. Trim cover board, so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

    a. Set cover board in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
    b. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
    c. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 INSTALLATION OF ROOFING MEMBRANE, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Where roof slope exceeds 1/2 inch per 12 inches, install roofing membrane sheets parallel with slope.

D. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.8 INSTALLATION OF BASE SHEET

A. Before installing, unroll base sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature.

B. Loosely lay one course of sheathing paper, lapping edges and ends a minimum of 2 inches and 6 inches, respectively.

C. Installation of SBS-Modified Fiberglass-Mat Base Sheet:

1. Install base sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.
2. Extend roofing sheets over and terminate above cants.
3. Install base sheet in a shingle fashion.
4. Torch-apply to substrate.

    a. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.

5. Install base sheet without wrinkles, rears, and free from air pockets.
6. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.

    a. Lap side laps as recommended by roof membrane manufacturer but not less than 3 inches.
    b. Lap end laps as recommended by roof membrane manufacturer but not less than 12 inches.
    c. Stagger end laps not less than 18 inches.
    d. Completely bond and seal laps, leaving no voids.
    e. Roll laps with a 20-pound roller.

7. Repair tears and voids in laps and lapped seams not completely sealed.
8. Apply pressure to the body of the base sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

3.9 INSTALLATION OF SBS-MODIFIED BITUMINOUS CAP SHEET

A. Before installing, unroll cap sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature at which cap sheet will be installed.

B. Install modified bituminous roofing cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.

1. Extend cap sheet over and terminate above cants.
2. Install cap sheet in a shingle fashion.
3. Install cap sheet as follows:

    a. Torch-apply to substrate.

        1) Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.

4. Install cap sheet without wrinkles or tears, and free from air pockets.
5. Install cap sheet so side and end laps shed water.

C. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.

1. Lap side laps as recommended by roof membrane manufacturer but not less than 3 inches.
2. Lap end laps as recommended by roof membrane manufacturer but not less than 12 inches.
3. Stagger end laps not less than 18 inches.
4. Completely bond and seal laps, leaving no voids.
5. Roll laps with a 20-pound roller.
6. Repair tears and voids in laps and lapped seams not completely sealed.

D. Apply pressure to the body of the cap sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

E. Apply roofing granules of same color as roof membrane to cover exuded bead at laps while bead is hot, to provide a continuous color appearance.

3.10 INSTALLATION OF FLASHING AND STRIPPING

A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Flashing Sheet Application, Hot: Torch-apply flashing sheet to substrate.

    a. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.

B. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 4 inches onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

D. Install liquid flashing system according to manufacturer's recommendations.

1. Extend liquid flashing not less than 3 inches in all directions from edges of item being flashed.
2. Embed granules, matching color of roof membrane, into wet compound.

E. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.

B. Perform the following tests:

1. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped water within roof assembly according to ASTM D7954/D7954M.

a. Perform tests before overlying construction is placed.
b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.

1) Cost of retesting is Contractor's responsibility.

c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

E. Roofing system will be considered defective if it does not pass tests and inspections.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.12 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

1. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 5216

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed sheet metal fabrications.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 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.

1.5 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. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

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

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; 2D (dull, cold rolled) finish.

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designationor aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

A. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D 226/D 226M for Type I and Type II felts.

B. Self-Adhering, High-Temperature Sheet: Minimum 30 mils 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. Carlisle Coatings & Waterproofing Inc; CCW WIP 300HT.
    b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Grace Ice and Water Shield HT.
    c. Henry Company; Blueskin PE200 HT.
    d. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

2.4 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 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 and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

    a. Exposed Fasteners: Not permitted.
    b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
    c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Solder:

1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. 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 wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED REGLETS

A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.

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. Cheney Flashing Company.
b. Fry Reglet Corporation.
c. Heckmann Building Products, Inc.
d. Hickman Company, W. P.
e. Hohmann & Barnard, Inc.
f. Keystone Flashing Company, Inc.
g. National Sheet Metal Systems, Inc.

h. Sandell Manufacturing Co., Inc.

2. Material: Stainless steel, 0.019 inch thick .
3. Finish: Mill With manufacturer's standard color coating Manufacturer's standard color coating for all visible components; and mill finish where not visible.

2.6 FABRICATION, GENERAL

A. 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.

B. 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 deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

C. 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.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. 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.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

2.7 SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12-foot- long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

3.2 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 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.

1. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feetwith no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch 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 9200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel sheet.
2. Do not use torches for soldering.
3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. 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 6200

SECTION 07 7100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Copings.
2. Roof-edge specialties.
3. Roof-edge drainage systems.
4. Reglets and counterflashings.

B. Related Requirements:

1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 5423 "Thermoplastic Polyolefin (TPO) Roofing" for sheet metal work completed as part of TPO roofing system.
3. Section 07 7200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
4. Section 07 9200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.

4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

C. Samples: For each type of roof specialty and for each color and texture specified.

D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

E. Samples for Verification:

1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
2. Include copings made from 12-inch lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Product Test Reports: For copings, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.

1. Build mockup of typical roof edge as part of Integrated Exterior Mockup specified in Section 01 4000 "Quality Requirements"
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. SPRI Wind Design Standard: Manufacture and install [copings] [roof-edge specialties] tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. 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, ambient; 180 deg F, material surfaces.

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Basis-of-Design: Subject to compliance with requirements, provide ATAS International, Inc.; ATAS Continuous Cleat Coping, or comparable product by one of the following:

a. Architectural Products Company.
b. Berridge Manufacturing Company.
c. Castle Metal Products.
d. Cheney Flashing Company.
e. Hickman Company, W. P.
f. Metal-Era, Inc.
g. PAC-CLAD; Petersen Aluminum Corporation.
h. SAF (Southern Aluminum Finishing Company, Inc.).

2. Formed Aluminum Sheet Coping Caps: Aluminum sheet, 0.050 inch thick.

a. Surface: Smooth, flat finish.
b. Finish: Two-coat fluoropolymer .
c. Color: As selected by Architect from manufacturer's full range.

3. Corners: Factory mitered and continuously welded.
4. Coping-Cap Attachment Method: face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.

a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
b. Face-Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.3 ROOF-EDGE SPECIALTIES

A. Canted Roof-Edge Fascia and Gravel Stop: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.

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. Architectural Products Company.
    b. ATAS International, Inc.
    c. Berridge Manufacturing Company.
    d. Castle Metal Products.
    e. Cheney Flashing Company.
    f. Drexel Metals.
    g. Hickman Company, W. P.
    h. Merchant and Evans.
    i. Metal-Era, Inc.
    j. PAC-CLAD; Petersen Aluminum Corporation.
    k. SAF (Southern Aluminum Finishing Company, Inc.).

2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.050 inch thick.

    a. Surface: Smooth, flat finish.
    b. Finish: Two-coat fluoropolymer .
    c. Color: As selected by Architect from manufacturer's full range.

3. Corners: Factory mitered and continuously welded.
4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
5. Fascia Accessories: Fascia extenders with continuous hold-down cleats Overflow scuppers.

2.4 ROOF-EDGE DRAINAGE SYSTEMS

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. Architectural Products Company.
2. ATAS International, Inc.
3. Berger Building Products, Inc.
4. Castle Metal Products.
5. Cheney Flashing Company.
6. CopperCraft by FABRAL.

7. Drexel Metals.
8. Exceptional Metals.
9. Hickman Company, W. P.
10. Merchant and Evans.
11. Metal-Era, Inc.
12. Perimeter Systems; a division of SAF.
13. SAF (Southern Aluminum Finishing Company, Inc.).

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Aluminum Sheet: 0.050 inch thick.
2. Gutter Profile: As indicated according to SMACNA's "Architectural Sheet Metal Manual."
3. Embossed Surface: Embossed with design as indicated by manufacturer's designations.
4. Corners: Factory mitered and continuously welded.
5. Gutter Supports: Manufacturer's standard supports as selected by Architect with finish matching the gutters.

C. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Formed Aluminum: 0.040 inch thick.

D. Parapet Scuppers: Manufactured with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof.

1. Stainless Steel: 0.0188 inch thick.

E. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge, and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout, exterior flange trim,.

1. Formed Aluminum: 0.032 inch thick.

F. Splash Pans: Fabricate from the following exposed metal:

1. Stainless Steel: 0.0188 inch thick.

G. Aluminum Finish: Two-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.

H. Stainless Steel Finish: ASTM A480/A480M No. 2B (bright, cold rolled, unpolished).

2.5 REGLETS AND COUNTERFLASHINGS

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. Berridge Manufacturing Company.
2. Castle Metal Products.
3. Cheney Flashing Company.
4. Drexel Metals.
5. Exceptional Metals.
6. Fry Reglet Corporation.
7. Heckmann Building Products, Inc.
8. Hickman Company, W. P.
9. Keystone Flashing Company, Inc.
10. Metal-Era, Inc.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Stainless Steel: 0.0188 inch thick.
2. Corners: Factory mitered and soldered.
3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:

1. Formed Aluminum: 0.032 inch thick.

    a. Use in conjunction with aluminum roof specialties, and where exposed to view from ground level or out of windows from the interior of the building.

2. Stainless Steel: 0.0250 inch thick.

    a. Use at rooftop locations where not exposed to view from ground level.

D. Aluminum Finish: Two-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.

E. Stainless Steel Finish: ASTM A480/A480M No. 2B (bright, cold rolled, unpolished).

2.6 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

2.7 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

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. Carlisle Residential; a division of Carlisle Construction Materials.
b. GCP Applied Technologies Inc.
c. Henry Company.
d. Metal-Fab Manufacturing, a Drexel Metals Company.
e. Owens Corning.
f. Protecto Wrap Company.
g. SDP Advanced Polymer Products Inc.

2. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F.
3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F.

B. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. minimum.

2.8 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.

B. Elastomeric Sealant: ASTM C920, elastomeric [polyurethane] [silicone] polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

E. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

F. Solder for Copper: ASTM B32, lead-free solder.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Aluminum Sheet Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

1. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

B. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

C. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.

3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum and stainless steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 INSTALLATION OF COPINGS

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.
2. Interlock face-leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

3.5 INSTALLATION OF ROOF-EDGE SPECIALITIES

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 INSTALLATION OF ROOF-EDGE DRAINAGE-SYSTEM

A. Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 30 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.

1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.

1. Provide elbows at base of downspouts at grade to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant.

E. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
2. Loosely lock front edge of scupper with conductor head.
3. Seal or solder exterior wall scupper flanges into back of conductor head.

F. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch below scupper discharge.

3.7 INSTALLATION OF REGLETS AND COUNTERFLASHINGS

A. Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Embedded Reglets: See Section 04 2000 "Unit Masonry" for installation of reglets.

C. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

D. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 7100

SECTION 07 7200 - ROOF 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. Roof curbs.
2. Equipment supports.
3. Preformed flashing sleeves.

B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Section 07 7100 "Roof Specialties" for shop- and field-formed metal flashing, roof-drainage systems, and miscellaneous sheet metal trim and accessories.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

D. Delegated-Design Submittal: For roof curbs equipment supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design roof curbs and equipment supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind-Restraint Performance: As indicated on Drawings.

2.2 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

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. Adaptable Air Products.
b. AES Industries, Inc.
c. Air Balance; a division of MESTEK, Inc.
d. Conn-Fab Sales, Inc.
e. Curbs Plus, Inc.
f. Custom Solution Roof and Metal Products.
g. Greenheck Fan Corporation.
h. KCC International Inc.
i. Kingspan Light + Air, North America.
j. Lloyd Industries, Inc.
k. LMCurbs.
l. Louvers & Dampers, Inc.; a division of Mestek, Inc.
m. Metallic Products Corp.
n. Milcor; Commercial Products Group of Hart & Cooley, Inc.

o. Pate Company (The).
p. Plenums Incorporated.
q. Roof Curb Systems.
r. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
s. Roof Products, Inc.
t. Sunoptics.
u. Thybar Corporation.
v. Vent Products Co., Inc.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.

D. Material: Stainless steel sheet, 0.0781 inch Insert dimension thick.

1. Finish: Manufacturer's standard ASTM A480/A480M, No. 2D, directional polish finish Insert finish.

E. Construction:

1. Curb Profile: Profile as indicated on Drawings compatible with roofing system.
2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
3. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange.
5. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
6. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
7. Liner: Same material as curb, of manufacturer's standard thickness and finish.
8. Nailer: Factory-installed wood nailer along top flange of curb, continuous around curb perimeter.
9. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
10. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch- thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
11. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.3 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced perimeter Rail-type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, and integrally formed structure-mounting flange at bottom.

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. Adaptable Air Products.
b. AES Industries, Inc.
c. Air Balance; a division of MESTEK, Inc.
d. Conn-Fab Sales, Inc.
e. Curbs Plus, Inc.
f. Custom Solution Roof and Metal Products.
g. Greenheck Fan Corporation.
h. KCC International Inc.
i. Lloyd Industries, Inc.
j. LMCurbs.
k. Louvers & Dampers, Inc.; a division of Mestek, Inc.
l. Milcor; Commercial Products Group of Hart & Cooley, Inc.
m. Pate Company (The).
n. Plenums Incorporated.
o. Roof Curb Systems.
p. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
q. Roof Products, Inc.
r. Thybar Corporation.
s. Vent Products Co., Inc.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.

D. Material: Stainless steel sheet, 0.0781 inch thick.

1. Finish: Manufacturer's standard.

E. Construction:

1. Curb Profile: Profile as indicated on Drawings compatible with roofing system.

2. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
3. Nailer: Factory-installed continuous wood nailers 3-1/2 inches wide on top flange of equipment supports, continuous around support perimeter.
4. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
5. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch- thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
6. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
7. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.
8. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.4 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted perforated metal collar.

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. Custom Solution Roof and Metal Products.
    b. Menzies Metal Products.
    c. Thaler Metal Industries Ltd.

2. Metal: Aluminum sheet, 0.063 inch thick.
3. Diameter: As indicated on Drawings.
4. Finish: Manufacturer's standard.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

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. Custom Solution Roof and Metal Products.
    b. Menzies Metal Products.
    c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
    d. Thaler Metal Industries Ltd.

2. Metal: Aluminum sheet, 0.063 inch thick.

3. Height: 13 inches.
4. Diameter: As indicated on Drawings.
5. Finish: Manufacturer's standard.

2.5 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.

1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.

2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Aluminum Sheet: ASTM B209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.

2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

C. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

D. Stainless Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666, Type 304.

E. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

F. Steel Tube: ASTM A500/A500M, round tube.

G. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.

H. Steel Pipe: ASTM A53/A53M, galvanized.

2.6 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Glass-Fiber Board Insulation: ASTM C726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.

C. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

F. Underlayment:

1. Slip Sheet: Building paper, 3 lb/100 sq. ft. minimum, rosin sized.
2. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

G. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

H. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

I. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

J. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

K. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of [uncoated aluminum] [stainless steel] roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.

F. Seal joints with elastomeric butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 9113 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 7200

SECTION 07 8413 - PENETRATION FIRESTOPPING

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. Penetrations through fire-resistance rated construction, including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrations.
2. Expansion and control joints in fire rated walls, floors, floor-ceiling and roof-ceiling assemblies.
3. Voids at the intersections of fire rated walls, floors, floor-ceilings, and roof-ceiling assemblies.
4. Intersections and penetrations of floors, ceilings, walls and columns.
5. Firestopping penetrations, created under Work of this project in fier-resistance rated construction at existing buildings.

1.3 REFERENCES

A. The following publications govern the work of this Section and are hereby incorporated in the Contact Documents as if bound herein. The Standards described apply generally unless specifically indicated otherwise in the text. They are idientified below by their publishers and are referred to in the text by basic designation only.

1. AMERICAN SCOIETY FOR TESTING AND MATERIALS (ASTM)

a. ASTM E84-91 a Surface Burning Charactersitics of Building Materials
b. ASTM C 1193-91 Guide for Use of Joint Sealants
c. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2012
d. ASTM E814 - Standard Test Method for Fire Test Method for Fire Tests of Penetration Firestop Systems.
e. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011)
f. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2010

g. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymer materials to Fungi; 2009

2. UNDERWRITERS LABORATORIES (UL)

a. UL-05 Fire Resistance Directory
b. UL 723 - Test for Surface Burning Characteristics of Building Materials
c. UL 1479 - Fire Tests of Through Penetration Firestops
d. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; 2004

3. OTHER TESTING SERVICES AND AGENCIES

a. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition
b. FM 4991 - Approval of Firestop Contractors; Factory Mutual Research Corporation; 2001
c. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
d. SCAQMD 1168 - South Coast Air Quality management District Rule No. 1168; current edition

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Manufacturer's descriptive data, installation instructions and fire-test data and/or report asappropriate for the fire resistance rated construction and location.
2. Submittal shall indicate the firestopping material to be provided with each type of application.

B. Shop Drawings

1. Show illustration details as appropriate for the dire resistance rated construction and locations required. When more than five (5) penetrations are to receive firestopping, drawings shall indicate location and type of application.
2. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
3. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.5 INFORMATIONAL SUBMITTALS

A. Certificates: Certificates attesting that firestopping material complies with the specific requirements. The label of listing of teh Underwriters laboratories will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing agency equipped to perform such services, stating that the items have been tested and conform to the specified requirements and testing.

B. Qualification Data: For Installer.

1. Manufacturer's certification stating that each installer is qualified and trained to install the specified requirements and testing.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.8 MOCK-UP

A. Install one firestopping assembly representative of each fire rating designrequired on project.

1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.

B. If acceptable, mock-up will represent the minimum standard for the Work.

C. If accepted, mock-up may remain as part of the Work.

1.9 SYSTEM DESCRIPTION

A. Firestopping shall consist of furnishing and installing a material or combination of materials to form an effective barrier against the spread of flame, smoke, and gases, and maintain the integrity of fire resistance rated walls, barriers, partitions, floors, floor/ceiling/roof assemblies. including through penetrations and construction joints. Through penetrations include the annular spaces around pipes, tube, conduits, wire, cables, and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping materials shall not interfere with required mevement of joints.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.11 STORAGE AND DELIVERY

A. Materials shall be delivered in the original un-opened packages or containers showing names of the manufacturer and th brand name of the product. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

1.12 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 FIRESTOPPING MATERIALS, GENERAL

A. Firestopping materials shall consist of commercially manufactured products complying with the following minimum requirements:

1. Fire hazard Classification: Material shall have a flame spread of 25 or less, and a smoke development rating of 50 or less, when testes in accordance with ASTM E 84 or UL 723. Materials shall be non-toxic to humans at all stages of the application and performance of the materials.
2. Fire Resistance Rating: Firestopping willnot be required to have a greater fire resistance rating than that of the assembly in which it is being installed within. Fire resistance ratings of construction joints as described in Part 1 Article "System Description" and gaps such as the construction in which they occur.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

    a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

        1) UL in its "Fire Resistance Directory."
        2) Intertek Group in its "Directory of Listed Building Products."
        3) FM Approval in its "Approval Guide."

2.3 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. 3M Fire Protection Products.
    b. A/D Fire Protection Systems Inc.
    c. Construction Solutions.
    d. Grabber Construction Products.
    e. Hilti, Inc.
    f. HOLDRITE.
    g. NUCO Inc.
    h. Passive Fire Protection Partners.
    i. RectorSeal.
    j. Specified Technologies, Inc.

k. STC Sound Control.
l. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Fire resistanace rated wall include fire walls, fire barriers, smoke barriers, and fire partitions.

2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.

a. ProVent Systems, Inc.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials including the following:

a. Slag-wool-fiber or rock-wool-fiber insulation
b. Sealants used in combination with other forming/damming/backing materials used to prevent leakage of fill materials in liquid state.
c. Fire-rated form board
d. Fillers for sealant.

2. Temporary forming materials
3. Substrate primers.

4. Collars.
5. Steel sleeves.

2.4 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

1. Cast-In-Place Firestop Device for non-cobustible and combustible pipes, conduits and cable bundles penetrating concrete floors:

a. Basis of Design Product: CP680P Cast in place firestop device as manufactured by Hilti, Inc. or comparable product by one of the following:

1) Johns Mansville
2) Nelson Firestop Products
3) Specified Technologies Inc.
4) 3M Fire Protection Product Division

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

1. Grade: Pourable (self-leveling) formulation for openings in floors andother horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both conditions.

2.5 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that woudl otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestoppings seal with substrates.

3.3 INSTALLATION

A. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

B. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

C. Firestopping materials shall completely fill void spaces regardless of geometric configuration, subject to tolerances established by the manufacturer. Firestopping for filling floor voids 4 inches or more in any direction shall be capable of supporting the same load as the floor is designated to support or shall be protected by barrier to prevent loading of traffic in the firestopped area. Firestopping shall be provided int eh following locations:

1. Penetrations of duct, conduit, tubing, cable and pipe though floors and through fire resistance rated walls, barriers, partitions, floors ceilings, and roof assemblies.
2. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
3. Gaps at the intersection of floor and curtain walls, including inside of hollow curtain walls at the floor slab.
4. Construction joints in floors and fire rated walls and partitions.
5. Gaps at perimeter of fire resistance rated walls, barriers, and partitions, such as between the top of walls and the bottom of roof decks.
6. Other locations where required to maitain fire resistance rated construction.

D. Penetrations made in existing building walls shall be sealed and firestopped the same day they are made. Existing holes within existing building walls abutting new construction or within areas of new construction uncovered by demolition procedures shall be sealed and firestopped.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 8413

SECTION 07 9100 - PREFORMED JOINT SEALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preformed, precompressed, expanding foam joint seals for expansion in exterior walls

B. Related Requirements:

1. Section 07 9200 "Joint Sealants" for liquid sealants applied over preformed seals in dual-seal systems.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Preformed, foam joint seals.

B. Samples for Initial Selection: Manufacturer's color sheets, showing full range of available colors for each type of exposed preformed joint seal.

C. Samples for Verification: Actual samples of each type and color of exposed preformed joint seal.

1. Size: 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint seals.

1.3 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace preformed joint seals that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. For preformed joint seals, obtain each color, type, and variety of joint seal from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PREFORMED, FOAM JOINT SEALS

A. Preformed, Foam Joint Seals : Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce them in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.

1. Basis of Design Product: Subject to compliance with requirements, provide Emseal Joint Systems, Ltd. Seismic Colorseal/Colorseal preformed silicone coated joint seal or comparable product by another manufacturer.
2. Design Criteria:

    a. Nominal Joint Width: As indicated on Drawings.
    b. Movement Capability: plus and minus 50% (total of 100%) of nominal material size.

3. Joint Seal Color: As selected by Architect from full range of industry colors.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by preformed joint seal manufacturer for joint substrates indicated.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to preformed joint seal manufacturer, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces, and formulated to promote best adhesion to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with preformed joint seals and surfaces adjacent to joints.

D. Sealant for Adhering Extruded-Silicone Joint Seals: Silicone adhesive sealant recommended by extruded-silicone joint seal manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive preformed joint seals, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting preformed joint seal 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 preformed joint seals to comply with preformed joint seal manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of preformed joint seal, including dust, paints (except for permanent protective coatings tested and approved for seal adhesion and compatibility by seal manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimal bond with preformed joint seals. 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. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint seals. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by preformed joint seal manufacturer or as indicated by tests or prior experience. Apply primer to comply with joint seal manufacturer's written instructions. Confine primers to areas of joint seal bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of adhesive or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. General: Comply with preformed joint seal manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Installation of Preformed, Foam Joint Seals:

1. Install each length of seal immediately after removing protective wrapping.
2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

3.4 PROTECTION

A. Protect preformed joint seals from damage resulting from construction operations or other causes so seals are without deterioration or damage at time of Substantial Completion.

B. Cut out, remove, and repair damaged or deteriorated seals so repaired areas are indistinguishable from original work.

END OF SECTION 07 9100

SECTION 07 9200 - 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. Section Includes:

1. Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:

   a. Control and expansion joints in unit masonry
   b. Joints between materials
   c. Perimeter joints between materials and frames of doors and windows.
   d. Other joints as indicated.

2. Exterior in horizontal traffic surfaces as indicated below:

   a. Control and isolation joints in cast-in-place concrete slabs.
   b. Joints btween different materials
   c. Other joints as indicated.

3. Interior joints in vertical surfcaes and horizontal non-traffic surfaces as indicated below:

   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints of exterior openings where indicated.
   c. Joints between tops of non-load bearing unit masonry and concrete walls and partitions.
   d. Tile control and expansion joints
   e. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
   f. Perimeter joints between interior wall surfaces and frames of interior doors and windows.

1.3 DEFINTIONS

A. Joint Sealants- caulk, caulking or joint sealers/sealants are synonomous and mean joint sealants as herein described.

B. Exterior- Joints at exterior surfaces of the building, whether or not directly exposed to the weather.

C. Interior- Joints at interior surfaces of the building but not exposed to weather in any manner.

D. Paving- Joints in floor slabs, sidewalks, steps, ramps, and curbs.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and maintain watertight and airtight continuous seals without casuing staining or deterioration of joint substrates.

B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no stianing or deterioration of joint subsrtates.

1.5 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

B. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.

C. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

D. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

E. Field-Adhesion-Test Reports: For each sealant application tested.

F. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Conduct field tests for each kind of sealant and joint substrate.
2. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
3. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.9 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.10 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:

1. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

1. Multiple selant colors may be chosen by Architect to acheive aesthetic value. Vertical or horizontal joints may consist of mulitple selant colors transitioning at differing materials.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 790.
    b. May National Associates, Inc.; Bondaflex Sil 728 NS
    c. Pecora Corporation; 311 NS
    d. Tremco Incorporated; Spectrem; 800

2.3 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 786-M White.
    b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
    c. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 100 WF.
    d. Soudal USA; RTV GP.
    e. Tremco Incorporated; Tremsil 200.

2.4 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. BASF Construction Chemicals - Building Systems; Sonolac.
    b. Pecora Corporation; AC-20.
    c. Tremco Incorporated; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealants: Manufacurer's standard nonsag, paintable nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements provide one of the following:

a. Pecora Corporation; AS-20 FTR
b. USG Corporation; SHEETROCK Acoustical Sealant.

2.6 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and other locations indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeter and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations and instructions.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

   a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
   b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

    a. Isolation and contraction joints in cast-in-place concrete slabs.
    b. Tile control and expansion joints.
    c. Joints between different materials listed above.
    d. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, S, NS, 100/50, T.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Construction joints in cast-in-place concrete.
    b. Control and expansion joints in unit masonry.
    c. Joints in dimension stone cladding.
    d. Joints in exterior insulation and finish systems.
    e. Joints between metal panels.
    f. Joints between different materials listed above.

g. Perimeter joints between materials listed above and frames of doorswindows and louvers.
h. Control and expansion joints in ceilings and other overhead surfaces.
i. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint Sealant Application: Interior joints on exposed interior surfaces and horizontal non-traffic surfaces of acoustic construction.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of walls receiving acoustic sensitive materials/construction.
b. Perimeter joints between interior wall surfaces and frames of interior windows and doors.
c. Perimeter joints of wall and partitions between ceilings and floors.
d. Acoustical joints where indicated.

2. Joint Sealant: Acoustical
3. Joint Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 9200

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Related Requirements:

1. Section 08 3473.13 "Metal Sound Control Door Assemblies" for packaged, acoustically rated hollow-metal door and frame assemblies.
2. Section 08 7100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

C. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861

1.4 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.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. 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. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.

D. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
2. Fabrication: Prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:

a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

E. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

B. Product Test Reports: For each type of door assemblies list below for tests performed by qualified testing agency indicating compliance with performance requirements:

1. Fire-rated hollow-metal door and frame assembly.
2. Fire-rated borrowed-lite assembly.
3. Thermally rated door assemblies.

C. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

D. Field quality control reports.

1.7 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

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.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs 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 space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. Republic Doors and Frames. Basis of Design
4. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.38 deg Btu/F x h x sq. ft. when tested according to ASTM C518.

2.3 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. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At all locations unless indicated otherwise.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Core: Polyurethane.
g. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.

b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Knocked down.

3. Exposed Finish: Prime.

2.4 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. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. At all exterior doors and frames unless otherwise indicated..

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Manufacturer's standard Polyurethane Vertical steel stiffener.
i. Fire-Rated Core: Manufacturer's standard vertical steel stiffener with insulation core for fire-rated doors.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.5 BORROWED LITES

A. Fabricate of metallic-coated steel sheet, minimum thickness of 0.053 inch.

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.7 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

D. 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.

E. 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.

F. Glazing: Comply with requirements in Section 08 8000 "Glazing."

2.8 FABRICATION

A. Door Astragals: Provide overlapping astragal 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 or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite 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 welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.

4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 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. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: .

1. Hollow-Metal Frames: Comply with ANSI/SDI A250.11 or NAAMM-HMMA 840 to comply with requirements.
2. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

3. Fire-Rated Openings: Install frames according to NFPA 80.
4. Floor Anchors: Secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

5. Solidly pack mineral-fiber insulation inside frames.
6. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
7. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8 NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door according to NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 1113

SECTION 08 3113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Access doors and frames.
2. Fire-rated access doors and frames.

1.3 COORDINATION

A. Each Contractor is required to provide access panels to the General Contractor for installation. It shall be the responsibility of each contractor to provide all access doors and frames required to access their concealed equipment, valves, controls and similar items requiring access and located behind finished surfaces. Each Contractor shall determine specific location and sizes of access doors and frames required to gain access to concealed equipment, valves, controls, etc. and indicated on schedule under "ACTION SUBMITTALS" article of this Section.

1. General Contractor shall coordinate the submission of the schedule of access doors and frames from each Contractor for submission at same time.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.

C. Product Schedule: For access doors and frames.

1. Schedule shall indicate type of substrate, location, size, and latching/locking provisions for each access door and frame.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing and inspecting agency.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

1.6 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.7 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges :

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. Acudor Products, Inc.
b. Babcock-Davis.
c. Cendrex Inc.
d. Elmdor/Stoneman Manufacturing Company; a division of Acorn Engineering Company.
e. JL Industries, Inc.; a division of the Activar Construction Products Group.

f. Karp Associates, Inc.
g. Lane-Aire Manufacturing Corp.
h. Larsens Manufacturing Company.
i. Maxam Metal Products Limited.
j. Metropolitan Door Industries Corp.
k. MIFAB, Inc.
l. Milcor; a division of Hart & Cooley, Inc.
m. Nystrom.
n. Williams Bros. Corporation of America (The).

2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Optional Features: Gasketing.
4. Locations: Wall and ceiling.
5. Door Size: Door size shall be sufficient to operate concealed valves, service concealed equipment, manipulate controls, or other similar functions. Additionally, door sizes shall be sufficient to comply with AHJ requirements..
6. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory primed.
7. Frame Material: Same material and thickness as door.
8. Latch and Lock: Cam latch, hex-head wrench operated .

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Concealed Flanges :

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. Acudor Products, Inc.
b. Babcock-Davis.
c. Cendrex Inc.
d. JL Industries, Inc.; a division of the Activar Construction Products Group.
e. Karp Associates, Inc.
f. Maxam Metal Products Limited.
g. Metropolitan Door Industries Corp.
h. MIFAB, Inc.
i. Nystrom.
j. Williams Bros. Corporation of America (The).

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
3. Optional Features: Gasketing.
4. Locations: Wall and ceiling.

5. Door Size: Door size shall be sufficient to operate concealed valves, service concealed equipment, manipulate controls, or other similar functions. Additionally, door sizes shall be sufficient to comply with AHJ requirements..
6. Fire-Resistance Rating: Not less than that of adjacent construction 2 hours.
7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gage, factory primed.
8. Frame Material: Same material, thickness, and finish as door.
9. Latch and Lock: Self-closing, self-latching door hardware, operated by key.

2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

C. Aluminum Extrusions: ASTM B221, Alloy 6063.

D. Aluminum Sheet: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

E. Frame Anchors: Same material as door face.

F. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.5 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 3113

SECTION 08 4113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Storefront framing for punched openings.
3. Exterior and interior manual-swing entrance doors.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:

    a. Deflection exceeding specified limits.
    b. Thermal stresses transferring 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 by thermal and structural movements.
    e. Loosening or weakening of fasteners, attachments, and other components.
    f. Sealant failure.
    g. Failure of operating units.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings..

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

D. Structural-Test Performance: Provide aluminum-framed 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 Durations: As required by design wind velocity, but not fewer than 10 seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft..

F. Water Penetration under Static Pressure: Provide aluminum-framed systems 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..

G. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
2. Interior Ambient-Air Temperature: 75 deg F.

H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.

I. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

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.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. 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. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

D. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems 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 caused by thermal movements.
c. Deterioration of metals and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.
e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

1.11 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. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Trifab VG 451T for exterior use and Trifab VG 451 for interior use both as manufactured by Kawneer Companyor comparable product by one of the following:

1. EFCO Corporation.
2. Pittco Architectural Metals, Inc.
3. TRACO.
4. Tubelite.
5. United States Aluminum.
6. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.

5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Nonthermal and Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center .

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. 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] [, fabricated from stainless steel].

D. 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.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Section 08 8000 "Glazing."

2.5 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: Medium stile; 3-1/2-inch nominal width.

    a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

    a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware 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 named manufacturers' 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 lbfto 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.

B. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame.

C. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

D. 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.

E. Cylinders: As specified in Section 08 7100 "Door Hardware."

F. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

G. Operating Trim: BHMA A156.6.

H. 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 meet field conditions and requirements for opening force.

I. Concealed Overhead Holders: BHMA A156.8, Grade 1.

J. Surface-Mounted Holders: BHMA A156.16, Grade 1.

K. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

L. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.

M. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

N. Silencers: BHMA A156.16, Grade 1.

O. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 07 9200 "Joint Sealants."

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Framing Members, General: 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. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from .
7. 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.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

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 FINISHES

A. High-Performance Organic Finish: 3 -coat fluoropolymer finish complying with AAMA 2605 and 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.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

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:

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.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 07 9200 "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Section 08 8000 "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.

H. Install perimeter joint sealants as specified in Section 07 9200 "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 08 4113

SECTION 08 7100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware not specified in Division 28 sections.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

C. Samples: For each exposed product in each finish specified.

D. Door hardware schedule.

E. Keying schedule.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedule.
2. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC) and an Electrified Hardware Consultant (EHC).

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Electromagnetic Locks: Five years from date of Substantial Completion.
b. Exit Devices: Two years from date of Substantial Completion.
c. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the DOJ's "2010 ADA Standards for Accessible Design" the DOT's "ADA Standards for Transportation Facilities" the ABA standards of the Federal agency having jurisdiction ICC A117.1 HUD's "Fair Housing Accessibility Guidelines" Insert regulation.

2.2 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.

2.3 HINGES

A. Butt Hinges: BHMA A156.1. Provide template-produced hinges for installation on hollow-metal doors, aluminum storefront doors, and hollow-metal frames.

1. Type: Five-knuckle, full mortise, concealed bearing.
2. Weight: Heavy weight.
3. Size: 4.5 inches by 4.5 inches.
4. Base metal: Stainless steel.
5. Bearing type: Concealed, oil- and grease-free, maintenance-free.
6. Pin type: stainless steel.
7. Finish: US 32D, Satin Stainless Steel.
8. Non-Removable Pin Option: Where indicated, provide manufacturer's standard NRP non-removable pins held in place by set screw through hinge barrel, concealed when hinge is in closed position.
9. Electrified Hinge Option: Where indicated, provide manufacturer's standard concealed wiring option for conducting current to electrified door hardware. Provide hinge with appropriate number of conductors and wire gauge as required by electrified hardware.
10. Security Stud Option: Where indicated, provide manufacturer's optional round stud welded to one hinge leaf, and aligning hole in the opposite leaf.

11. Basis-of-Design Product: Subject to compliance with requirements, provide Stanley Commercial Hardware; CB199, with options enumerated in each Hardware Set, or comparable product by one of the following:

    a. Baldwin Hardware Corporation.
    b. Bommer Industries, Inc.
    c. Don-Jo Mfg., Inc.
    d. Hager Companies.
    e. McKinney Products Company; an ASSA ABLOY Group company.

B. Wide Throw Butt Hinges: BHMA A156.1. Provide template produced hinges for installation on hollow metal doors, aluminum storefront doors, and hollow metal frames.

1. Type: Five-knuckle, full mortise, concealed bearing.

2. Weight: Heavy Weight.
3. Size: 4.5 x 4.5 inches
4. Base Metal: Stainless steel.
5. Bearing type: COncealed, oil- and grease-free, maintenance-free.
6. Pin type: Stianless steel
7. Finish: US 32D, Satin Stainless Steel
8. Non-Removeable Pin Option: Where indicated, provide manufacturer's standard NRP non-removeable pins held in place by set screw through hinge barrel, concealed when hinge is in closed position.
9. Electrified Hinge Option: Where indicated, provide manufacturer's standard concealed wiring option for conducting current to electrified door hardware. provide hinge with appropriate number of conductors and wire gauge as required by electrified hardware.
10. Security Stud Option: Where indicated, provide manufacturer's optional round stud welded to one hinge leaf, and aligning hole in the opposite leaf.
11. Basis of Design Product: Subjec tto compliance with requirements, provide Stanley Commercial Hardware; FBB199, with options enumerated in each Hardware Set, or comparable product by one of the following:

    a. Baldwin Hardware Corporation
    b. Bommer Industries, Inc.
    c. Don-Jo Mfg. Inc.
    d. Hager Companies
    e. McKinney Products Company; an ASSA ABLOY Group company.

2.4 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26-1996, Grade 1; minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Type: Full mortise.
2. Weight: Heavy weight.
3. Size: Full height of door.
4. Base metal: Extruded Aluminum.
5. Bearing type: Integral polymer PTFE bearing.
6. Hinge type: meshed gear profile, with full covering.
7. Finish: Clear Satin Anodized.
8. Electrified Hinge Option: Where indicated, provide manufacturer's standard concealed wiring option for conducting current to specified electrified door hardware. Provide hinge with appropriate number of conductors and wire gauge as required by electrified hardware.

9. Basis-of-Design Product: Subject to compliance with requirements, provide Stanley Commercial Hardware; Aluminum Continuous Geared Hinge 661 HD, or comparable product by one of the following:

    a. Allegion plc.
    b. Bommer Industries, Inc.
    c. Hager Companies.
    d. McKinney Products Company; an ASSA ABLOY Group company.
    e. Pemko Manufacturing Co.
    f. Zero International, Inc.

2.5 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
3. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: ADA-accessible, "L" shaped lever consisting of a round spindle and rectangular profivle lever, with hooked end returning to within 1/2 inch of door face; and a flat profile, squared-edge, round escutcheon plate with concealed fasteners, prepared for key cylinder.
2. Levers: Solid cast Zamac
3. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

F. Cylindrical Locks: BHMA A156.2; Operational Grade 2; non-handed; 2-3/4 inch backset, 2-1/4 inch diameter cylinder prep.

1. Functions: As indicated in the Hardware Schedule for each unit.
2. Keying: 6 pin, Medeco X4 BCP keyway

3. Basis of Design Product: Subject to compliance with requirements, provide Marks USA 175 Economy Series Cylindrical Locksets.

G. Auxiliary Bored Locks: BHMA A156.36, Operational Grade 1. Non-handed, 2 ¾" backset, 2 ¼ inch diameter cylindrical prep, 1 inch throw, solid steel bolt, with free-spinning steel pin insert.

1. Functions: As indicated in the Hardware Schedule for each unit.
2. Base Metal: Stainless Steel for all exposed parts; dichromate- or rust-inhibitive-plated steel body.
3. Finish: BHMA 32D Satin Stainless Steel.
4. Thumbturns: ADA-compliant, requiring no pinching or grasping to rotate to an unlocked position; with cam compatible with hardware functions indicated.
5. Basis of Design Product: Adams Rite MS1850 series deadlocks.

2.6 ELECTRIC STRIKES

A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.

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. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
b. Dortronics Systems, Inc.
c. HES, Inc.; an ASSA ABLOY Group company.
d. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
e. Stanley Commercial Hardware; a division of Stanley Security Solutions.

2.7 MANUAL FLUSH BOLTS

1. Finish: US 26D Satin Chrome Plated.
2. Strikes: Provide mortise strike for head, and spring-loaded, flanged dust-proof strike for floor.

3. Basis of Design Product: Subject to compliance with requirements, provide Don-Jo 1555-Flush Bolt.

2.8 CONSTANT-LATCHING FLUSH BOLTS

A. Constant-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge. Include wear plates.

1. Configuration: Top and bottom bolt housings flush-mortised into strike edge of door leaf, completely concealed from view when door is in closed position.

2.9 EXIT DEVICES

A. Exit Devices: BHMA A156.3.

1. Type Rim type.
2. Configuration: Standard width design with square housing and full length push pad, and lever-type trim where trim is indicated.
3. Base Metal: Stainless steel for exposed parts.
4. Keying: 6 pin, Medeco X4 BCP keyway
5. Finish: US 32D Satin Stainless Steel
6. Basis of Design Product: Subject to compliance with requirements, provide Marks USA X-it M9900 Exit Device.

    a. Lever/Rose: Where indicated provide M195F to match cylindrical locksets.

2.10 KEYING

A. Keyway: Medeco 6 pin X4BCP keyway; No exceptions/substitutions.

B. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

1. Grand Master Key System: Provide a Three-Level Grand Master Key System comprised of multiple Master Key sub-systems with Change Keys, and a Grand Master key that operates all cylinders. Assume not less than three (3) Master Key sub-systems under the Grand Master, each with multiple Change Keys.
2. Keying Subcontractor shall conduct a Keying Conference with the Owner to establish the following:

    a. Number of master key sub-systems.
    b. Number of change Keys within each master key sub-system.
    c. Locks within each master key sub-system that shall be keyed to the same change key, or keyed separately.

C. Keys: Nickel silver.

1. Key Blanks: Custom F3F2 key blanks.

2. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

    a. Notation: "DO NOT DUPLICATE."

2.11 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel unless otherwise indicated.

B. Pull Plates: "D" shaped stainless steel fixed pull with square outside edges and rounded inner gripping surface, and 3-1/2 inch by 15 inch by 0.062 inch stainless steel mounting plate; US32D brushed stainless steel finish; through-bolted, with flat head machine screws and finishing washers.

1. Basis of Design Product: Don-Jo 7010 Pull Plate

C. Push Plates: 4 inch x 16 inch x 0.062 inch flat stainless steel, US32D satin finish; fastened to door with 6 oval head stainless steel screws.

1. Basis of Design Product: Don-Jo 71 Push Plate

2.12 ACCESSORIES FOR PAIRS OF DOORS

A. Astragals: BHMA A156.22.

1. Mortised Smoke Seal Astragals: 2-part smoke-seal-rated system for installation in vertical mortises machined into the meeting stiles of pairs of doors, consisting of (1) extruded aluminum insert in one leaf, and (1) extruded aluminum insert with neoprene bulb seal and fin in opposing leaf; bulb seal presses against opposing aluminum insert to create a smoke-tight seal.

a. Basis-of-Design: Zero International; 36AA 36" Clear Anodized Mortised Astragal with Neoprene.

2. Surface Fire and Smoke Seal Astragal: 1-part smoke seal system comprised of a resilient double-fin profile and additional heat-activated intumescent seals, with self-adhesive backing installed to meeting rail or inactive leaf of a pair of doors to create a smoke-tight and heat-resistant seal.

a. Basis-of-Design: NGP National Guard Products; NGP Edge, Intumescent with TPE Fins Fire and Smoke Seal.

3. "T" Astragal: Extruded mill aluminum "T" profile with captive vinyl finned weatherstrip, in continuous length to match door, for installation on the exterior meeting stile edge of one door leaf in a pair of doors to create a weathertight, draft-resistant seal.

a. Basis-of-Design: Pemko; 38ZA75 Double Door Weatherstrip T-Astragal With Vinyl Insert.

B. Coordinators: BHMA A156.3; Tubular steel body with protruding spring-loaded door control tabs, configured to mount directly to door frame rabbet, with inner operating components completely concealed within housing; custom-length to suit door opening width and configured for compatibility with specific hardware indicated.

1. Basis-of-Design: Rockwood NX23600 Series Door Coordinator.

2.13 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

B. Provide Surface Closers of configuration and arm type for mounting on interior and room-side of doors, unless specifically indicated otherwise.

1. For push side closer mounting, provide parallel arm option.
2. For pull side closer mounting, provide track arm option.

C. Provide full metal cover option.

D. Provide overhead stop option where indicated in Door Hardware Sets. Stop point shall be field-adjustable.

E. Provide overhead holder option where indicated in Door Hardware Sets. Hold open point shall be field-adjustable.

F. Size closer for each door based on Manufacturer's recommendation for weight and height of door; wind conditions; and location of closer.

G. Where overhead door control items are indicated to be used on the same door leaf in conjunction with surface closers, coordinate the closer type, mounting location, and bracket types to ensure full operation and intended functionality of closer and overhead door control device.

H. Basis of Design Product: Subject to compliance with requirements, provide Corbin-Russwin; DC6210-M54.

2.14 MECHANICAL STOPS AND HOLDERS

A. Wall-Mounted Stops: BHMA A156.16.

1. Basis of Design Product: Subject to compliance with requirements, provide Don-Jo; #1407 or #1413.

B. Floor-Mounted Stops: BHMA A156.16.

1. Basis of Design Product: Subjec tto compliance with requirements, provide Don-Jo; #1440 or # 1442.

C. Lever/Kickstand Door Mounted Holder: BHMA A156.16

1. Basis of Design Product: Subject to compliance with requirements, provide Don-Jo; #1464.

2.15 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

B. General: Track-and-arm configuration, with track surface mounted to door, pivoting arm mounted to door frame, and pin of pivoting arm riding in track.

C. Material: Stainless steel base metal, US32D satin brushed finish.

D. Opening Angle: Up to 110 degrees.

E. Compression Stop Feature: Heavy-duty shock-absorber spring mechanism concealed in track, providing 5 to 7 degrees of compression before dead-stop.

F. Where indicated, provide holdopen option, with adjustable hold-open angle and tension.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Rixson; CheckMate #9 Series or comparable product by one of the following:

a. Architectural Builders Hardware Mfg., Inc.
b. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
c. SARGENT Manufacturing Company; ASSA ABLOY.

2.16 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide NGP National Guard Products; 152VA or comparable product by one of the following:

a. Sealeze.
b. Zero International, Inc.

B. Maximum Air Leakage: When tested according to ASTM E 283 with tested pressure differential of 0.3-inch wg, as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.
2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
3. Gasketing on Double Doors: 0.50 cfm per foot of door opening.

2.17 MEETING STILE GASKETING

A. Door Gasketing: BHMA A156.22; resilient or flexible seal strip adhesively attached to one side of meeting stile of double doors.

1. Basis of Design Product: Subject to compliance with requirements, provide Pemko S772_ or comparable product by one of the following:

a. NGP National Guard Products
b. Sealeze
c. Zero International, Inc.

2.18 DOOR SWEEPS

A. Door Sweep: "U" profile extruded aluminum for slip fit over bottom edge of door, with removable finned resilient bulb in bottom retaining track.

1. Basis of Design Product: Pemko 222AV.

2.19 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

B. Configuration: Mill-aluminum, thermally-improved, ADA-accessible, with resilient gasket bumper seal.

1. Basis-of-Design Product: Subject to compliance with requirements, provide NGP National Guard Products 896 or comparable product by one of the following:

a. Hager Companies.
b. M-D Building Products, Inc.
c. Pemko Manufacturing Co.
d. Reese Enterprises, Inc.
e. Zero International, Inc.

2.20 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick stainless steel; with manufacturer's standard screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Don-Jo Mfg., Inc.

2.21 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware:

1. Where indicated in the Hardware Schedule, as specified in Division 28 Specifications sections.
2. Where electrified door hardware is indicated to be provided by Owner's vendor, fully coordinate the locations, preparation, pathway, and other fabrication and installation requirements with the Owner's vendor.

2.22 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

E. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening with electrified door hardware.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 9200 "Joint Sealants."

H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.2 ADJUSTING

A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.3 DOOR HARDWARE SCHEDULE

A. The Door Hardware Schedule is appended following this Section.

END OF SECTION 08 7100

SECTION 08 8000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

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 in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.

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 qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturers of fabricated glass units.

B. Product Certificates: For glass.

C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification 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 C1021 to conduct the testing indicated.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with 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 instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD 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 are below 40 deg F.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: 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 for 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 for 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 obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

D. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent within specified warranty period. Coverage for any other cause is excluded.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain tinted coated glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 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 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. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings.
2. 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, whichever is less.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

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 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, in accordance with NFRC 100 and based on LBL's WINDOW 7 computer program, expressed as Btu/sq. ft. x h x deg F.
5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on LBL's WINDOW 7 computer program.
6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm Insert thickness designation.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Ultraclear Annealed Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent and SHGC of not less than 0.87.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

a. Viracon, Inc.

D. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction .
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they 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. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

2.8 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 C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. 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 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.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by 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:

1. Neoprene with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Neoprene with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

2.10 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.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

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

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.

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 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. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. 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.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. 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 in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 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 in writing 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 in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. 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.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass Type :

1. Overall Unit Thickness: 1 inch.
2. Minimum Thickness of Each Glass Lite: 6 mm.
3. Outdoor Lite: Ultraclear fully tempered float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Ultraclear fully tempered float glass.
6. Low-E Coating: Sputtered on second surface.

    a. Basis of Design Product: Subject to compliance with requirements, provide Vitro Architectural Glass Solarban 90 (2) Clear + Clear or approved equivalent.

7. Winter Nighttime U-Factor: 0.29 maximum.
8. Summer Daytime U-Factor: 0.27 maximum.
9. Visible Light Transmittance: 51% percent minimum.
10. SGHC: 0.23 maximum.
11. Safety glazing required where indicated.

END OF SECTION 08 8000

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For embossed, high-strength steel studs and tracks firestop tracks post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Horizontal Deflection: For non-composite wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 10 lbf/sq. ft..

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for steel unless otherwise indicated.
2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C 645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.

1. Steel Studs and Tracks:

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) CEMCO; California Expanded Metal Products Co.
2) ClarkDietrich Building Systems.
3) MarinoWARE.
4) MBA Building Supplies.
5) MRI Steel Framing, LLC.
6) Phillips Manufacturing Co.
7) Steel Network, Inc. (The).
8) Telling Industries.

b. Minimum Base-Steel Thickness: As indicated on DrawingsAs required by performance requirements for horizontal deflection.

c. Depth: As indicated on Drawings .

2. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional ASTM C 645 steel studs and tracks.

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) CEMCO; California Expanded Metal Products Co.
2) ClarkDietrich Building Systems.
3) MarinoWARE.
4) MBA Building Supplies.
5) Phillips Manufacturing Co.
6) Steel Network, Inc. (The).
7) Telling Industries.

b. Minimum Base-Steel Thickness: As indicated on DrawingsAs required by horizontal deflection performance requirements.

1) Where not indicated on drawings, the minimum stud thickness shall be no less than 20 Gauge. ("20 Ga equivalent" is not compliant.)

c. Depth: As indicated on Drawings .

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Track System: ASTM C 645 top track with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Track System: ASTM C 645 top outer tracks, inside track with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Products: available products that may be incorporated into the Work include, but are not limited to, the following:

1) Blazeframe Industries; Bare Slotted Track (BST/BST 2).
2) CEMCO; California Expanded Metal Products Co.; SLP-TRK Slotted Deflection Track.
3) ClarkDietrich Building Systems; SLP-TRK Slotted Deflection Track.
4) MBA Building Supplies; Slotted Deflecto Track.
5) Metal-Lite; The System.

6) Steel Network, Inc. (The); VertiTrack VTD.
7) Telling Industries; Vertical Slip Track.

D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

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. Blazeframe Industries; Intumescent Framing, Fire Stop System.
b. CEMCO; California Expanded Metal Products Co.; FAS Track.
c. ClarkDietrich Building Systems; BlazeFrame.
d. Fire Trak Corp; Fire Trak System attached to studs with Fire Trak Posi Klip.
e. Metal-Lite; The System.

E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.

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. ClarkDietrich Building Systems.
b. MRI Steel Framing, LLC.

2. Depth: As indicated on Drawings.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

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. ClarkDietrich Building Systems.
b. MRI Steel Framing, LLC.

2. Minimum Base-Steel Thickness: 0.0296 inch.
3. Depth: As indicated on Drawings.

G. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

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. ClarkDietrich Building Systems.

b. MRI Steel Framing, LLC.

2. Configuration: Asymmetrical.

H. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: As indicated on Drawings.

I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ClarkDietrich Building Systems.
b. MRI Steel Framing, LLC.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Hanger Attachments to Concrete:

1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 AC193 AC58 or AC308 as appropriate for the substrate.

a. Uses: Securing hangers to structure.
b. Type: Torque-controlled, expansion anchor torque-controlled, adhesive anchor or adhesive anchor.
c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.

1. Depth: 2-1/2 inches.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
2. Steel Studs and Tracks: ASTM C 645.

    a. Minimum Base-Steel Thickness: As indicated on Drawings.
    b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

    a. Minimum Base-Steel Thickness: 0.0296 inch .

4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.

    a. Configuration: Asymmetrical.

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

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. Armstrong World Industries, Inc; Drywall Grid Systems.
    b. Chicago Metallic Corporation; 640/660 Drywall Ceiling Suspension 650/670 Fire Rated Drywall Ceiling Suspension.
    c. United States Gypsum Company; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

2. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
3. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
5. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 07 2100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 2216

SECTION 09 2400 - CEMENT PLASTERING (STUCCO)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal lath.
2. Base-coat cement plaster.
3. Cement plaster finish coats.
4. Accessories.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples: For each type of factory-prepared finish coat and for each color and texture specified.

D. Samples for Initial Selection: For each type of factory-prepared finish coat and for each color and texture specified.

E. Samples for Verification: For each type of factory-prepared finish coat and for each color and texture specified, 12 by 12 inches, and prepared on rigid backing.

1.4 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for each substrate and finish texture indicated for cement plastering, including accessories.

a. Size: 100 sq. ft. in surface area.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover, and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 FIELD CONDITIONS

A. Comply with ASTM C926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F.
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain plaster materials from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E119 by a qualified testing agency.

2.3 METAL LATH

A. Expanded-Metal Lath: ASTM C847, cold-rolled carbon-steel sheet with ASTM A653/A653M, G60, hot-dip galvanized-zinc coating.

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. Alabama Metal Industries Company; a Gibraltar Industries company.
    b. CEMCO; California Expanded Metal Products Co.
    c. ClarkDietrich.
    d. MarinoWARE.
    e. Phillips Manufacturing Co.

2. Diamond-Mesh Lath: Self-furring, 2.5 lb/sq. yd..
3. 3/8-Inch Rib Lath: 3.4 lb/sq. yd..

B. Paper Backing: FS UU-B-790a, Type I, Grade B, Style 1a vapor-retardant paper Insert requirements.

1. Provide paper-backed lath at exterior locations.

2.4 BASE-COAT CEMENT PLASTER

A. General: Comply with ASTM C926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:

1. Portland Cement Mixes:

    a. Basis of Design Product: Subject to compliance with requirements, provide one of the following products or comparable products by another manufacturer that will produce a finish to match existing adjacent fascia and soffit finish.

        1) Dryvit (CCP) Cement Plaster Base - Sanded; DS817 Fiberglass Reinforced Portland Cement Plaster Base.
        2) Dryvit (CCP) Cement Plaster Base - Concentrate; DS 818 Fiberglass Reinforced Portland Cement Base.

    b. Mix per manufacturer's written instructions and recommendations.

2.5 CEMENT PLASTER FINISH COATS

A. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems formulated with colorfast mineral pigments and fine aggregates; for use over cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.

1. Basis of Design Product: Subject to compliance with requirements, provide Dryvit CCP Acrylic Primer, Coating and Finish or comparable product by another manufacturer.

a. Primer: Provide primer that will produce a finish that best matched the existing adjacent fascia and sofit finish.

1) Dryvit Color Prime; DS410.
2) Dryvit Primer with Sand; DS477.

b. Coating: Dryvit Demandit Smooth or Sanded; Provide coating that best matched the existing adjacent fascia and soffit finish.
c. Finish: Dryvit DPR; DS416

1) Texture: As selected by Architect from manufacturer's standard textures to match existing adjacent fascia and soffit; Minimum of 5 standard textures to choose from.

2. Color: Standard or Custom color to match existign adjacent fascia and soffit color.

2.6 ACCESSORIES

A. General: Comply with ASTM C1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

1. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A653/A653M, G60 zinc coating.
2. Cornerite: Fabricated from metal lath with ASTM A653/A653M, G60, hot-dip galvanized-zinc coating.
3. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A653/A653M, G60, hot-dip galvanized-zinc coating.
4. Cornerbeads: Fabricated from zinc-coated (galvanized) steel or anodized aluminum.

a. Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
b. Smallnose cornerbead with perforated flanges; use on curved corners.
c. Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.

5. Casing Beads: Fabricated from zinc-coated (galvanized) steel or anodized aluminum; square-edged style; with expanded flanges.
6. Control Joints: Fabricated from or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
7. Expansion Joints: Fabricated from or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.

2.7 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in cement plaster.

C. Bonding Compound: ASTM C932.

D. Fasteners for Attaching Metal Lath to Substrates: ASTM C1063.

E. Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter unless otherwise indicated.

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. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare smooth, solid substrates for plaster according to ASTM C926.

3.3 INSTALLATION OF METAL LATH

A. Metal Lath: Install according to ASTM C1063.

1. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.

3.4 INSTALLATION OF ACCESSORIES

A. Install according to ASTM C1063 and at locations indicated on Drawings.

B. Reinforcement for External (Outside) Corners:

1. Install cornerbead at exterior locations.

C. Control Joints: Locate as approved by Architect for visual effect and as follows:

1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:

a. Match joint pattern and spacing of existing fascia and soffit.

2. Where control joints occur in surface of construction directly behind plaster.
3. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.5 APPLICATION OF BASE-COAT CEMENT PLASTER

A. General: Comply with ASTM C926.

1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces when measured by a 10-foot straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Walls; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork with 3/4-inch total thickness, as follows:

1. Portland cement mixes.

C. Ceilings; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork and having 3/4-inch total thickness for metal lath on concrete, as follows:

1. Portland cement mixes.

3.6 APPLICATION OF CEMENT PLASTER FINISH COATS

A. Acrylic-Based Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.

3.7 REPAIR

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.8 CLEANING

A. Remove temporary protection and enclosure of other work after plastering is complete.

B. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered.

C. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 2400

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 09 2216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
2. Section 09 3013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each item indicated.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. 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. Certainteed Gypsum
2. Georgia Pacific Gypsum LLC.
3. National Gypsum Company
4. USG Corporation

B. Gypsum Wallboard: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

D. Flexible Gypsum Board: ASTM C1396/C1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch.
2. Long Edges: Tapered.

E. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

F. Impact-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.

1. Core: As indicated on Drawings.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
5. Hard-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements according to test in Annex A1.
6. Long Edges: Tapered.

G. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: As indicated.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 SPECIALTY GYPSUM BOARD

A. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistive capability.

1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
2. Long Edges: Tapered.

B. Glass-Mat Interior Gypsum Board: ASTM C1658/C1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.

1. Core: As indicated.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

C. Acoustically Enhanced Gypsum Board: ASTM C1396/C1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core.

1. Core: As indicated.
2. Long Edges: Tapered.

2.5 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.

1. Core: As indicated on Drawings.
2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

B. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Thickness: As indicated.
2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.
    g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type tapingcompound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

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 high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.
3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.8 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Thermal Insulation: As specified in Section 07 2100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. 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.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Type X: As indicated on Drawings.
3. Flexible Type: Apply in double layer at curved assemblies.
4. Ceiling Type: Ceiling surfaces.
5. Impact-Resistant Type: As indicated on Drawings.
6. Mold-Resistant Type: As indicated on Drawings.
7. Type C: Where required for specific fire-resistance-rated assembly indicated.
8. Glass-Mat Interior Type: As indicated on Drawings.
9. Acoustically Enhanced Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.

2. On partitions/walls, apply gypsum panels 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 panels.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at showers, tubs, and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated.

C. Water-Resistant Backing Board: Install where indicated with 1/4-inch gap where panels abut other construction or penetrations.

D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.
5. Curved-Edge Cornerbead: Use at curved openings.

D. Exterior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for acoustical tile.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."

5. Level 5: Where indicated on drawings and where required for finish installation. Coordinate all gypsum board surfaces with finish system providers and installers.

    a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 2900

SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Initial Selection: For components with factory-applied finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Set of 6-inch- square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.
3. Clips: Full-size hold-down clips.

E. Delegated-Design Submittal: For seismic restraints for ceiling systems.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.

2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.
4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.

7. Minimum Drawing Scale: 1/4 inch = 1 foot .

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by [manufacturer and witnessed by a qualified testing agency] [a qualified testing agency].

D. Evaluation Reports: For each acoustical panel ceiling suspension system[and anchor and fastener type], from ICC-ES.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, 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. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANELS CLG-1

A. Basis-of-Design Product: Subject to compliance with requirements, provide Fissured; 895 as manufactured by Armstrong or comparable product by one of the following:

1. American Gypsum.
2. Armstrong World Industries, Inc.
3. CertainTeed Corporation.
4. Chicago Metallic Corporation.
5. Tectum Inc.
6. United States Gypsum Company.

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide panels as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
2. Pattern: CD((perforated, small holes and fissured) .

D. Color: White .

E. Light Reflectance (LR): Not less than 0.75 .

F. Ceiling Attenuation Class (CAC): Not less than 35.

G. Noise Reduction Coefficient (NRC): Not less than 0.55.

H. Edge/Joint Detail: Square .

I. Thickness: 5/8 inch .

J. Modular Size: 24 by 48 inches .

K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 ACOUSTICAL PANEL CLG-2

A. Basis of Design Product: Subject to compliance with requirements, provide Clean Room FL; 1715 as manufactured by Armstrong World Industries, Inc. or comparable product by another manufacturer.

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acosutical rating, and light relfectance unless otherwise indicated.

C. Classification: Provide panels as follows:

1. Type and Form: Type IV; Form 2, water felted.
2. Pattern GH (smooth and printed).

D. Color: White.

E. Light Reflectance (LR): Not less than 0.75.

F. Ceiling Attenuation Class (CAC): Not less than 35.

G. Noise Reduction Coefficient (NRC): Not less than 0.55.

H. Edge/Joint Detail: Square.

I. Thickness: 3/4 inches.

J. Modular Size: 24 by 24 inches.

K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.5 METAL SUSPENSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Prelude XL suspension system or comparable product by one of the following:

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. United States Gypsum Company.

2.6 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Cast-in-place Postinstalled expansion Postinstalled bonded anchors.

2. 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 hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
4. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- 0.135-inch- Insert dimension diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

E. Hold-Down Clips: Manufacturer's standard hold-down.

F. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

G. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

H. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

I. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

J. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including manufacturer's standard closed-cell PVC neoprene antimicrobial gasket and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.

1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
3. Install hold-down clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

    a. Hold-Down Clips: Space 24 inches o.c. on all cross runners.

4. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

SECTION 09 6513 - RESILIENT 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. Thermoplastic-rubber base.
2. Rubber molding accessories.

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. Samples for Initial Selection: For each type of product indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following 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 THERMOPLASTIC-RUBBER BASE VB-1

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. Allstate Rubber Corp.
2. Armstrong World Industries, Inc.
3. Burke Mercer Flooring Products; a division of Burke Industries Inc.
4. Flexco.
5. Johnsonite; A Tarkett Company. Basis of Design Product
6. Nora Systems, Inc.
7. Roppe Corporation, USA.
8. VPI Corporation.

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style and Location:

a. Style B, Cove: .

C. Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Colors: As selected by Architect from manufacturer's full range..

2.2 RUBBER MOLDING ACCESSORY

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. Roppe Corporation, USA.
2. VPI Corporation.

B. Description: Rubber cap for cove carpet cap for cove resilient floor covering carpet bar for tackless installations carpet edge for glue-down applications nosing for carpet nosing for resilient floor covering reducer strip for resilient floor covering joiner for tile and carpet transition strips.

C. Profile and Dimensions: As indicated.

D. Colors and Patterns: As selected by Architect from manufacturers full range.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

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. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas. Provide one or both tests below as recommended and/or required by product manufacturer(s).

    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install 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.

E. 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. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with 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. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 6513

SECTION 09 6723 - RESINOUS 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. Resinous flooring.
2. Integral cove base accessories.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review manufacturer's written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
2. Review details of integral cove bases.
3. Review manufacturer's written instructions for installing resinous flooring systems.
4. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

B. Samples: For each resinous floor system required and for each color and texture specified, 6 inches square in size, applied to a rigid backing by Installer for this Project.

C. Samples for Initial Selection: For each type of exposed finish required.

D. Samples for Verification: For each resinous flooring system required and for each color and texture specified, 36 inches square, applied to a rigid backing by Installer for this Project.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each resinous flooring component.

C. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Apply full-thickness mockups on 96-inch- square floor area selected by Architect.

a. Include 96-inch length of integral cove base with inside and outside corner.

2. Simulate finished lighting conditions for Architect's review of mockups.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

C. Close spaces to traffic during resinous flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 RESINOUS FLOORING

A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.

1. Basis of Design Product: Subject to compliance with requirements, provide Key Resin Company; Key MMA Chip 900 Colored Flake Methyl Methacrylate Flooring system or comparable product by another manufacturer.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

C. System Characteristics:

1. Color and Pattern: As selected by Architect from manufacturer's full range.
2. Wearing Surface: Textured for slip resistance .
3. Overall System Thickness: 1/4 inch.

D. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested in accordance with test methods indicated:

1. Compressive Strength: 6,000 psi minimum in accordance with ASTM C579.
2. Tensile Strength: 3000 psi minimum in accordance with ASTM C307.
3. Indentation: 5 percent maximum in accordance with MIL-D-3134J.
4. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation in accordance with MIL-D-3134J.

5. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch in accordance with MIL-D-3134J.
6. Abrasion Resistance: 32 mg maximum weight loss in accordance with ASTM D4060.
7. Hardness: 70-75, Shore D in accordance with ASTM D2240.

E. Primer: Type recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated.

F. Waterproofing Membrane: Type recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated.

G. Reinforcing Membrane: Flexible resin formulation that is recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated and that inhibits substrate cracks from reflecting through resinous flooring.

H. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended in writing by manufacturer for installation indicated.

I. Body Coats:

1. Resin: Methyl methacrylate.
2. Formulation Description: 100 percent solids.
3. Type: Pigmented.
4. Installation Method: Self-leveling slurry with broadcast aggregates .
5. Aggregates: Vinyl flakes.

J. Grout Coat:

1. Resin: Methyl methacrylate.
2. Formulation Description: 100 percent solids.
3. Type: Pigmented.

K. Topcoats: Sealing or finish coats.

1. Resin: Methyl methacrylate.
2. Formulation Description: 100 percent solids.
3. Type: Clear.
4. Number of Coats: Two.
5. Finish: Matte.

2.2 INTEGRAL COVE BASE ACCESSORIES

A. Precast, Integral Cove Base: Impact-resistant, polymer-resin, cove base moldings with a grit profile to promote adhesion of resinous flooring and recommended in writing by resinous flooring manufacturer.

1. Radius Cove: Cove molding with approximately 1-inch radius for adhesive installation at floor-to-wall joint as substrate to receive resinous flooring system to form an integral cove base.
2. Radius Cove Base: 4-inch- high base molding that provides approximately 1-inch radius cove at floor-to-wall joint; for adhesive installation as substrate for resinous flooring system to form an integral cove base.

B. Installation Adhesive: As recommended in writing by accessory 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 resinous flooring systems.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare and clean substrates in accordance with resinous flooring manufacturer's written instructions for substrate indicated to ensure adhesion.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
b. Comply with requirements in SSPC-SP 13/NACE No. 6, with a Concrete Surface Profile of 3 or greater in accordance with ICRI Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete in accordance with resinous flooring manufacturer's written instructions.

3. Moisture Testing: Perform tests so that each test area does not exceed 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.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by resinous flooring manufacturer. Proceed with installation only after substrate alkalinity is not less than 6 or more than 8 pH unless otherwise recommended in writing by flooring manufacturer,

C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.

1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.

D. Resinous Materials: Mix components and prepare materials in accordance with resinous flooring manufacturer's written instructions.

3.3 INSTALLATION

A. Apply components of resinous flooring system in accordance with manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness specified.

1. Coordinate installation of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components in accordance with manufacturer's written instructions. Prevent contamination during installation and curing processes.
3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at spreading rate recommended in writing by manufacturer.

C. Waterproofing Membrane: Apply waterproofing membrane over entire substrate surface, in thickness recommended in writing by manufacturer.

1. Apply waterproofing membrane to integral cove base substrates.

D. Reinforcing Membrane: Apply reinforcing membrane to entire substrate surface.

E. Integral Cove Base Accessories: Adhesively install precast accessories before applying flooring coats and in accordance with manufacturer's written instructions.

F. Field-Formed Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring coats. Apply in accordance with manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

1. Integral Cove Base: 4 inches high.

G. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness specified for flooring system.

1. Aggregates: Broadcast aggregates at rate recommended in writing by manufacturer. After resin is cured, remove excess aggregates to provide surface texture indicated.

H. Grout Coat: Apply grout coat to fill voids in surface of final body coat.

I. Topcoats: Apply topcoats in number indicated for flooring system specified, at spreading rates recommended in writing by manufacturer, and to produce wearing surface specified.

3.4 FIELD QUALITY CONTROL

A. Material Sampling: Owner may, at any time and any number of times during resinous flooring installation, require material samples for testing for compliance with requirements.

1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reinstall flooring materials to comply with requirements.

B. Core Sampling: At Owner's direction and at locations designated by Owner, take one core sample per 1000 sq. ft. of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

3.5 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 6723

SECTION 09 9123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

1. Concrete.
2. Concrete masonry units (CMUs).
3. Steel and iron.
4. Galvanized metal.
5. Gypsum board.
6. Acoustic panels and tiles.

B. Related Requirements:

1. Section 05 1200 "Structural Steel Framing" for shop priming structural steel.
2. Section 05 5000 "Metal Fabrications" for shop priming metal fabrications.
3. Section 05 5119 "Metal Grating Stairs" for shop priming metal grating stairs.
4. Section 05 5213 "Pipe and Tube Railings" for shop priming pipe and tube railings.
5. Section 05 5313 "Bar Gratings" for shop priming metal gratings.
6. Section 09 9600 "High-Performance Coatings" for tile-like coatings.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product. (Color Fan)

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Behr Process Corporation.
2. Benjamin Moore & Co.
3. Duron, Inc.
4. M.A.B. Paints.
5. PPG Architectural Coatings.
6. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings 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."

D. Colors: As selected by Architect from manufacturer's full range .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.
3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2.
2. SSPC-SP 3.
3. SSPC-SP 7/NACE No. 4.
4. SSPC-SP 11.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.

2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

    a. Equipment, including panelboards and switch gear.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Tanks that do not have factory-applied final finishes.
    h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

    a. Equipment, including panelboards.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    h. Other items as directed by Architect.
    i. <Insert mechanical items to be painted>.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. High-Performance Architectural Latex System MPI INT 3.1C:

    a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
    b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
    c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

B. CMU Substrates:

1. High-Performance Architectural Latex System MPI INT 4.2D:

    a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
    b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
    c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

C. Steel Substrates:

1. High-Performance Architectural Latex System MPI INT 5.1R:

    a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
    b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
    c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2).

D. Galvanized-Metal Substrates:

1. High-Performance Architectural Latex System MPI INT 5.3M:

a. Prime Coat: Primer, galvanized, water based, MPI #134.
b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), MPI #138.

E. Gypsum Board Substrates:

1. High-Performance Architectural Latex System MPI INT 9.2B:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.
b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

END OF SECTION 09 9123

SECTION 09 9600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:

   a. Concrete, vertical surfaces.
   b. Concrete masonry units (CMUs).
   c. Steel.
   d. Galvanized metal.

2. Interior Substrates:

   a. Concrete, vertical surfaces.
   b. Concrete masonry units (CMUs).
   c. Steel.
   d. Galvanized metal.
   e. Gypsum board.

B. Related Requirements:

1. Section 05 1200 "Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.
2. Section 05 5213 "Pipe and Tube Railings" for shop priming pipe and tube railings with coatings specified in this Section.
3. Section 09 9123 "Interior Painting" for general field painting.

1.3 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Behr Process Corporation.
2. Benjamin Moore & Co.
3. PPG Architectural Finishes, Inc.
4. Sherwin-Williams Company (The).

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings 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."

D. Color selection is often limited because some coating materials yellow or degrade under some environmental conditions.

E. Colors: As selected by Architect from manufacturer's full range .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

1. Clean surfaces with pressurized water. Use pressure range of 4000 to 10,000 psi at 6 to 12 inches .

E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.

1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches .

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 6/NACE No. 3.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.5 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Concrete Substrates, Vertical Surfaces:

1. Epoxy-Modified Latex System MPI EXT 3.1E:

a. Prime Coat: Epoxy-modified latex, matching topcoat.
b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.

B. CMU Substrates:

1. Epoxy System MPI EXT 4.2E:

a. Block Filler: Block filler, epoxy, MPI #116.
b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #77.

C. Steel Substrates:

1. Epoxy System MPI EXT 5.1F:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
c. Topcoat: Epoxy, gloss, MPI #77.

D. Galvanized-Metal Substrates:

1. Epoxy System MPI EXT 5.3C:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #77.

3.6 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Concrete Substrates, Vertical Surfaces:

1. Epoxy-Modified Latex System MPI INT 3.1G:

a. Prime Coat: Epoxy-modified latex, matching topcoat.
b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.

B. CMU Substrates:

1. Epoxy-Modified Latex System MPI INT 4.2J:

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.

C. Steel Substrates:

1. Epoxy-Modified Latex System MPI INT 5.1K:

a. Prime Coat: Primer, rust inhibitive, water based, MPI #107.
b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.

D. Galvanized-Metal Substrates:

1. Epoxy over Epoxy Primer System MPI INT 5.3D:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #77.

E. Gypsum Board Substrates:

1. Epoxy-Modified Latex System MPI INT 9.2F:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.
b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
c. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.

END OF SECTION 09 9600

SECTION 10 1423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes room-identification signs that are directly attached to the building.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Full-size Sample.
2. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
3. Exposed Accessories: Full-size Sample of each accessory type.
4. Full-size Samples, if approved, will be returned to Contractor for use in Project.

E. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [Installer] [and] [manufacturer].

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 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.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: [Manufacturer of products] [An entity that employs installers and supervisors who are trained and approved by manufacturer].

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.

c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign : Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ACE Sign Systems, Inc.
b. Advance Corporation.
c. Allen Industries Architectural Signage.
d. APCO Graphics, Inc.
e. ASE, Inc.
f. ASI Sign Systems, Inc.
g. Best Sign Systems, Inc.
h. Clarke Systems.
i. Cosco.
j. Diskey Architectural Signage Inc.
k. InPro Corporation (IPC).
l. Mohawk Sign Systems.
m. Nelson-Harkins Industries.
n. Poblocki Sign Company, LLC.
o. Seton Identification Products.
p. Signature Signs, Inc.
q. Signs & Decal Corp.
r. Stamprite Supersine; a division of Stamp Rite Inc.
s. Vista System.
t. Vomar Products, Inc.

2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.

a. Composite-Sheet Thickness: As indicated on Drawings.

b. Color(s): As selected by Architect from manufacturer's full range.

3. Sign-Panel Perimeter: Finish edges smooth.

a. Corner Condition in Elevation: As indicated on Drawings.

4. Mounting: Manufacturer's standard method for substrates indicated with two-face tape.
5. Text and Typeface: Accessible raised characters and Braille typeface as selected by Architect from manufacturer's full range andvariable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.

a. Room names may be changed through the shop drawing review process.

B. Location and Quantity: Signage shall be provided at a minimum of every doorway throughout the building. Provide two signs for every interior door. Final quantity shall be determined during shop drawing process but shall not be more than stated above.

2.3 SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

D. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings[and suitable for exterior applications].

E. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm Class II, 0.010 mm or thicker.

B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm Class II, 0.010 mm or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Mounting Methods:

1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 1423.16

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Underlavatory guards.
4. Custodial accessories.

1.2 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Samples: For each exposed product and for each finish specified, full size.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: As indicated on drawings.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
2. Shower Seats: Installed units are able to resist 360 lbf applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain each type of public-use washroom accessory from single source from single manufacturer.

B. Toilet Tissue (Jumbo-Roll) Dispenser TP-1:

1. Basis of Design Product: Subject to compliance with requirements, provide product as indicated on drawings or comparable product by another manufacturer.
2. Description: One-roll unit.

3. Mounting: Surface mounted.
4. Capacity: 9- or 10-inch- diameter rolls.
5. Material and Finish: ABS plastic, gray, with translucent front cover.
6. Lockset: Tumbler type.
7. Refill Indicator: Pierced slots at front.

C. Paper Towel (Roll) Dispenser PT-1:

1. Basis of Design Product: Subject to compliance with requirements, provide product as indicated on drawings or comparable product by another manufacturer.
2. Description: Pull-towel actuated mechanism permitting controlled delivery of paper rolls in preset lengths.
3. Mounting: Surface mounted.
4. Minimum Capacity: 8-inch- wide, 800-foot- long roll.
5. Material and Finish: ABS plastic, gray, with translucent front cover.
6. Lockset: Tumbler type.

D. Soap Dispenser LD-1:

1. Basis of Design Product: Subject to compliance with requirements, provide product as indicated on drawings or comparable product by another manufacturer
2. Description: Designed for manual operation and dispensing soap in liquid or lotion form.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 800 mL.
5. Materials: ABS Plastic, White.
6. Refill Indicator: Window type.

E. Grab Bar GB-#:

1. Basis of Design Product: Subject to compliance with requirements, provide product as indicated on drawings or comparable product by another manufacturer
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: As indicated on Drawings.

F. Mirror Unit MR-1:

1. Basis of Design Product: Subject to compliance with requirements, provide product as indicated on drawings or comparable product by another manufacturer
2. Frame: Stainless steel channel.

    a. Corners: Manufacturer's standard .

3. Size: As indicated on Drawings.
4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

G. Hook RH-1:

1. Basis of Design Product: Subject to compliance with requirements, provide product as indicated on drawings or comparable product by another manufacturer
2. Description: Double-prong unit .
3. Mounting: Concealed.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.4 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Source Limitations: Obtain [public-use shower room accessories] [each type of public-use shower room accessory] from single source from single manufacturer.

B. Shower Curtain Rod SR-1:

1. Basis of Design Product: Subject to compliance with requirements, provide product as indicated on drawings or comparable product by another manufacturer.
2. Description: Rectangular, curved, adjustable rod.
3. Configuration:
4. Mounting Flanges: Exposed fasteners; in material and finish matching rod.
5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Shower Curtain :

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. AJW Architectural Products.
    b. American Specialties, Inc. (ASI).
    c. Bobrick Washroom Equipment, Inc.
    d. Bradley Corporation.
    e. Brey-Krause Manufacturing Co.
    f. GAMCO Specialty Accessories; a division of Bobrick.
    g. Tubular Specialties Manufacturing, Inc.

2. Size: Minimum 12 inches wider than opening by 72 inches high.
3. Material: Duck, minimum 8 oz., white, 100 percent cotton.
4. Color: White.
5. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
6. Shower Curtain Hooks: Chrome-plated or stainless steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

D. Folding Shower Seat SHS-1:

1. Basis of Design Product: Subject to compliance with requirements, provide product as indicated on drawings or comparable product by another manufacturer.
2. Configuration: L-shaped seat, designed for wheelchair access .
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.5 UNDERLAVATORY GUARDS

A. Underlavatory Guard :

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. Buckaroos, Inc.
   b. Plumberex Specialty Products, Inc.
   c. Truebro by IPS Corporation.

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.6 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain [custodial accessories] [each type of custodial accessory] from single source from single manufacturer.

B. Custodial Utility Shelf SSS-1:

1. Basis of Design Product: Subject to compliance with requirements, provide product as indicated on drawings or comparable product by another manufacturer.
2. Description: Tubular steel rack with hanger bar.
3. Size: As indicated on Drawings.
4. Material and Finish: Not less than nominal 0.05-inch- thick stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.7 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.

B. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

C. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.8 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with 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.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Shower Seats: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 10 2800

SECTION 10 4413 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire protection cabinets for the following:

a. Portable fire extinguishers.

B. Related Sections:

1. Section 10 4416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.6 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Stainless-Steel Sheet: ASTM A 666, Type 304.

C. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), manufacturers standard thickness, with Finish 1 (smooth or polished).

2.2 FIRE PROTECTION CABINET FEC

A. Cabinet Type: Suitable for fire extinguisher .

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. Larsen's Manufacturing Company; Architectural Series Fire Extinguisher Cabinets.

B. Cabinet Construction: Nonrated.

C. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.

1. Rolled-Edge Trim

a. FEC: 1 1/2 inch backbend depth

D. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door opposite side of handle and glazing.
2) Lettering Color: White.

2.3 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicatedor, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.

END OF SECTION 10 4413

SECTION 10 4416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes portable, hand-carried wheeled fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:

1. Section 10 4413 "Fire Protection Cabinets."
2. Section 23 3813 "Commercial-Kitchen Hoods" for fire-extinguishing systems provided as part of commercial-kitchen exhaust hoods.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet andmounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International.
c. Babcock-Davis.
d. Badger Fire Protection.
e. Buckeye Fire Equipment Company.
f. Fire End & Croker Corporation.
g. Guardian Fire Equipment, Inc.
h. JL Industries, Inc.; a division of the Activar Construction Products Group.
i. Kidde Residential and Commercial Division.
j. Larsens Manufacturing Company.

k. MOON American.
l. Nystrom, Inc.
m. Oval Fire Products Corporation.
n. Potter Roemer LLC.
o. Pyro-Chem; Tyco Fire Suppression & Building Products.
p. Strike First Corporation of America (The).

2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
3. Valves: Manufacturer's standard.
4. Handles and Levers: Manufacturer's standard.
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container Insert drawing designation: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Fire extinguishers shall be placed in all fire extinguisher cabinets indicated within drawings as well as in all mechanical rooms, electrical rooms, and elevator machine rooms.

2. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 4416

SECTION 10 5126 - PLASTIC LOCKERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Solid plastic lockers.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
2. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's data sheets for each type of product indicated include fabrication details, description of materials and finishes.

1. Product Test Reports: When requested by Architect, provide documentation indicating compliance of products with requirements, from a qualified independent testing agency.

B. Shop Drawings: Include overall locker dimensions, floor plan, elevations, sections, details, and attachments to other work. Include choice of options with details.

C. Samples for Selection: Furnish samples of manufacturer's full range of colors for initial selection.

D. Samples for Approval: Furnish a physical sample of the material in the selected color.

1. Size: 6 by 6 inch in type of finish specified.

1.4 INFORMATIONAL SUBMITTALS

A. Installation instructions.

B. Warranty: Sample of special warranty.

1.5 MAINTENANCE SUBMITTALS

A. Operation and Maintenance Data.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain plastic lockers and trim accessories from single manufacturer.

B. Accessibility Requirements: Comply with requirements of ADA/ABA and with requirements of authorities having jurisdiction.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 100 or less.
2. Smoke-Developed Index: 450 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver plastic lockers to the site until the building is enclosed and HVAC systems are in operation. Deliver plastic lockers in manufacturer's original packaging. Store in an upright condition. Protect plastic lockers from exposure to direct sunlight.

B. Ship plastic lockers fully assembled.

C. Lift and handle plastic lockers from the base not the sides.

1.8 WARRANTY

A. Special Manufacturer's Warranty: 20 year against rust, delamination or breakage of plastic parts under normal use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. High Density Polyethylene (HDPE): 100 percent pre-consumer or post-consumer recycled content polyethylene thermoplastic formed under high pressure into solid plastic components.

B. Stainless-Steel Sheet: ASTM A 666, Type 304.

C. Fasteners: Tamper-Resistant Fasteners: Stainless steel torx-head screws.

1. Locker Connectors: No. 10-24 sex bolts.
2. Anchors: Type and size required for secure anchorage.
3. Drilled-in-place Masonry Anchors: Minimum 1/4 by 1-3/4 inch screws.

2.2 STANDARD PLASTIC LOCKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley LENOX "Z" LOCKER or comparable product by another manufacturer.

B. Locker Configuration: Two Tier

1. EQ-1: 15 inches wide x 18 inches deep x 72 inches high

C. Material: HDPE plastic, 100 percent recycled material.

D. Sides, Tops, Bottoms, Dividers, and Shelves: 3/8 inch thick HDPE plastic with smooth finish.

E. Locker Shelves: 3/8 inch HDPE plastic, mortised into sides and back.

F. Doors: Fabricate from a single piece 1/2 inch HDPE plastic.

1. Doors and Frame: 1/2 inch thick HDPE plastic with matte texture finish with cross-hatch mesh pattern.
2. Handle: ADA/ABA Compliant handle fabricated from injection molded plastic.
3. Locks: Standard hasp.
4. Hinges: Continuous piano hinges, .05 inch/18 gauge thick type 304 stainless steel fabricated to wrap around edges of door and frame and attached with stainless steel tamper-resistant screws.

    a. Finish: Powder coated to match color of locker.

5. Latch Bar: Full-height latch bar constructed of 1/2 inch HDPE plastic secured to locker with stainless steel tamper-resistant screws.

G. Color: As selected by Architect from manufacturer's full range.

H. Accessories:

1. Coat Hooks: Black polycarbonate double hook.
2. End Panels: 3/8 inch thick, with color and finish matching locker body.
3. Filler Panels: 1/2 inch HDPE filler panel, with color and finish matching locker body, attached with 3/8 inch thick HDPE solid plastic angle bracket.
4. Wall Hooks: Black powder coated, cast zinc hook two per locker.

5. Number Plate: White acrylic with black film coating, laser etched with number specified. Provide one per locker.
6. Locker Base: 1 inch solid HDPE plastic, with black or finish matching locker body, 4 inch high.
7. Coat Rod: Schedule 40 PVC with plastic pole sockets and stainless steel tamper-resistant screws.

2.3 LOCKER FABRICATION

A. Fabricate locker box from a single sheet of HDPE solid plastic with corners fused together. Weld frames and shelves to box assembly. Provide all welded construction of locker parts without dovetail slots or metal fasteners. Add welded gussets in single tier full height lockers.

B. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

C. Hardware Attachment: All hinges, handles, hasps, hooks, latch bars, and locks attached with tamper-resistant screws.

D. Provide ventilated panels where indicated.

E. Continuous Base: Set toe clearance 3 inch from locker front. Notch end caps for ease of installation.

F. Filler Panels: Fabricated in unequal leg angle shape; finished to match lockers.

G. Finished End Panels: Fabricated with 3/8 inch wide edge dimension, configured to conceal fasteners and holes at exposed ends of plastic lockers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lockers in climate controlled environment, shielded from direct sunlight.

B. General: Install on floor or other firm support. Install level, plumb, and true.

1. Position locker base per approved shop drawing. Using fasteners provided by manufacturer, anchor base sections to the floor.
2. Attach filler pieces to lockers with male-female sex bolts.
3. Position first locker according to submittal layout. Square and plumb the locker using concealed shims. Secure the locker to the wall at the top and bottom of the locker. Position second locker next to first, square and plumb to align the tops and bottoms; and temporarily clamp lockers together. Drill four holes through the sides of the lockers and connect lockers using sex bolts provided by manufacturer.

C. Accessories: Fit exposed connections of trim, fillers, and closures together to form tight, hairline joints, with concealed fasteners and splice plates furnished by locker manufacturer. Install as indicated on approved shop drawings.

1. Coat Hooks: Attach with at least two fasteners.
2. Coat Rods: Attach at height indicated.
3. Identification Plates: Identify plastic lockers with approved identification numbers. Attach plates to each locker door.
4. Filler Panels: Attach with concealed fasteners.
5. Finished End Panels: Attach at ends indicated.

3.2 FINAL CLEANING

A. Clean locker interior and exterior surfaces.

B. Remove packaging and construction debris and legally dispose of off-site.

END OF SECTION

SECTION 11 3016 - FIRE SERVICE APPLIANCES

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. Laundry appliances

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of appliance.

C. Sample Warranties: For manufacturers' special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.7 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

B. Laundry Equipment: Limited warranty, including parts and labor for first year and parts thereafter for on-site service on the product.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Gas-Fueled Appliances: Certified by a qualified testing agency for each type of gas-fueled appliance according to ANSI Z21 Series standards.

C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

2.2 FIRE SERVICE LAUNDRY EQUIPMENT

A. Extractor

1. Basis of Design Product: Subject to compliance with requirements, provide UniMac model UWT065D40LX, or comparable product by another manufacturer.
2. Product Requirements:

a. Construction and Cover Panels: 304 or equal stainless steel cylinder, tub.
b. Input Voltage: 200-240/60/3; Coordinate electrical requirements with drawings prior to purchasing equipment.

c. Dry Weight Capacity: 65 lbs.
d. Wash Cylinder Volume: 9.61 cu. ft. minimum.
e. Overall Width: Approximately 34.12 inches
f. Overall Height: Approximately 64.63 inches
g. Overall Depth: Approximately 49.83 inches.
h. Number and Size of Water Connections: Four with ¾ inch NH male.
i. Number and Size of Drain Outlets: One at 3 inches.
j. Overflow: Internally plumbed.
k. Control System: Programmable microprocessor.
l. Cylinder drive: Single motor, 5 hp with inverter drive, capable of 470 RPM through direct drive poly V belt.

3. Performance Requirements:

a. Number of Selectable Wash Speeds: Two
b. Number of Extract Speeds: One
c. G-force at Highest Extract Speed: 100
d. Chemical Supply System: Automatic flushing with connections for 5 external supply lines and control signals for external supplies.
e. Through the door jet-spray rinse system.
f. Control System:

1) Programmable microprocessor; manual keypad, Windows PDA or PC)
2) 41 cycle capability with graphic display of words or icons.
3) PC software interface with laundry management reports, network capability.
4) Real-time clock allows time/date stamp of 100+ items; maintenance reminder.
5) 30 programmable water levels.
6) Temperature controlled fill value, slow drain and automatic leak detection system.
7) Diagnostic capabilities.

g. Drain valve automatically opens in the event of power failure.

B. Dryer

1. Basis of Design Product: Subject to compliance with requirements, provide UniMac model UTGC6EDG45 or comparable product by another manufacturer.
2. Product Requirements:

a. Dry Capacity: 6 full sets of PPE and 15 boot/glove holders
b. Cabinet Volume: 69 cu. ft. minimum.
c. Construction: Heavy duty embossed steel with baked enamel powder paint.
d. Input Voltage: 200-240/60/3; Coordinate electrical requirements with drawings prior to purchasing equipment.
e. Heat Source: Electric, 12 kW
f. Overall Width: 61.125 inches

g. Overall Depth: 32.625 inches
h. Overall Height: 80.375 inches
i. Exhaust Size: 6 inch
j. Control System: Programmable touchpad control
k. Door: Painted steel with heavy duty 180 degree opening hinges
l. Leveling: Four adjustable leveling legs.

3. Performance Requirements:

a. Airflow: 300 cfm
b. Motor Horsepower: 2 x 1/8 hp
c. Control System:

1) Minimum of five programmable drying cycles.
2) Ability to time dry to 555 minutes
3) Ability to cool from 2 minutes to 60 minutes.
4) Variable temperature settings from 100 - 150 degrees F
5) Boot/Glove holders: 15 sets.

2.3 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain appliances.

END OF SECTION

SECTION 12 3661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material apron fronts.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. One full-size solid surface material countertop, with front edge and backsplash, 8 by 10 inches, of construction and in configuration specified.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements[after base cabinets are installed but] before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avonite Surfaces.
b. E. I. du Pont de Nemours and Company.
c. Formica Corporation.
d. LG Chemical, Ltd.
e. Meganite Inc.
f. Samsung Chemical USA, Inc.
g. Swan Corporation (The).

2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Colors and Patterns: As selected by Architect from manufacturer's full range.

B. Composite Wood Products: Products shall be made without urea formaldehyde.

C. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

2.2 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops:

1. 3/4-inch- thick, solid surface material with front edge built up with same material.

D. Backsplashes: 1/2-inch- thick, solid surface material.

E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.

F. Joints:

1. Fabricate countertops without joints.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures[in shop] using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

    a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
    b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
    c. Provide 3/4-inch full bullnose edges projecting 3/8 inch into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 9200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

E. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

G. Apply sealant to gaps at walls; comply with Section 07 9200 "Joint Sealants."

END OF SECTION 12 3661.16

SECTION 22 0500 - GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section pertains to general requirements for furnishing and installing plumbing systems.

B. Furnish all labor, materials, equipment, and incidentals to provide a complete plumbing system as shown on the Drawings and specified herein.

C. This Section includes:

1. Coordination
2. Permits
3. Calculations
4. Installation Services

D. Connections of electrical, control and instrumentation components shall be provided in accordance with Division 26.

1.2 INTERPRETATION OF DRAWINGS

A. Dimensions shown on the Drawings that are related to equipment are based on one manufacturer's equipment. Coordinate the dimensions of the equipment proposed to be furnished with the space allocated for that equipment.

B. The Drawings show the principal elements of the plumbing installation.

C. The Drawings are not intended as detailed working drawings for the plumbing Work but as a complement to the Specifications to clarify the principal features of the plumbing systems.

D. It is the intent of this Section that all equipment, piping, and devices, furnished and installed under this and other Sections, be properly connected and interconnected with other equipment or pipes so as to render the installations complete for successful operation, regardless of whether all the connections and interconnections are specifically mentioned in the Contract Documents or shown on the Drawings.

1.3 QUALITY ASSURANCE

A. Reference Standards: Comply with all Federal, State and Local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:

1. ANSI, American National Standards Institute.

2. ASTM, American Society for Testing and Materials.
3. AWWA, American Water Works Association.
4. PDI, Plumbing and Drainage Institute.
5. CISPI, Cast Iron Soil Pipe Institute.
6. NEMA, Standards of National Electrical Manufacturers.
7. OSHA, Occupational Safety and Health Act.

B. Regulatory Requirements:

1. Baltimore County Code and County modifications of the following adopted codes:
   a. International Building Code
   b. Maryland Building Performance Standards
   c. National Electrical Code
   d. International Mechanical Code
   e. International Plumbing Code
   f. International Fire Code
   g. International Energy Conservation Code
2. It is the intention of the Contract Documents that the work described therein is in compliance with codes. Should the Contractor or System Installer discover work shown or noted which is not in code compliance, he shall immediately notify the Engineer. He shall not install the work in contravention of any code provision.
3. All packaged equipment shall be independently third party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29 CFR 1910.303 and 1910.399, NFPA 70, and National Electric Code (NEC), Article 90-7.
4. Code provisions supersede the Contract Documents.
5. Notify the Owner of conflicts between code provisions and the Contract Documents prior to Shop Drawing submittals.
6. Permits:
   a. The plumbing Contractor shall apply for and obtain plumbing permits for all plumbing work.
   b. The plumbing Contractor will be the applicant and shall pay all associated permit fees.
   c. No plumbing work is to be started prior to issuance of a permit for such work.
   d. No plumbing work shall be started prior to furnishing to the Owner, a copy of such Plumbing Permit.
   e. The Contractor shall arrange for all inspections required by the Plumbing Inspector and shall inform the Owner of all pending inspection schedules.

C. Plumbing System Installer Qualifications - Installer shall:

1. Be a licensed plumbing contractor in the Local Authority Having Jurisdiction.

2. Have ten years, minimum, of experience in the installation and maintenance of industrial and heavy commercial plumbing systems.

3. Maintain a full-time, local, staff of engineers, technicians, and service/maintenance personnel.

1.4 SUBMITTALS

A. Shop drawings shall be submitted for all items specified herein in accordance with Section 01 33 00 “Submittal Procedures”. Shop drawings shall include, but not be limited to, physical characteristics, parts and materials lists, electrical characteristics, operating data, dimensional drawings, wiring diagrams, weights, and installation requirements.

B. Shop Drawings:

1. Submit Manufacturer's literature, specifications, installation diagrams, including isometrics and engineering data.

2. Detailed 1/4-inch scale drawings showing materials and dimensions of the complete piping systems, in plan and in section showing location and size of all fixtures, sleeves and pipes.

C. Record Drawings:

1. Prepare and submit comprehensive record drawings for the principal plumbing work performed under this Section in compliance with Section 01 78 39 “Project Record Documents.”

D. Product Data:

1. Submit data on new or replacement equipment and parts.

1.5 GENERAL REQUIREMENTS

A. Unless otherwise specified hereinafter, starters, pushbuttons, H-O-A switches, and other electrical items for the equipment shall be as specified and provided under the electrical sections of the specifications

1.6 WARRANTY AND GUARANTEE

A. Warranty and guarantee shall be for a period of one (1) year as specified in Section 01 60 00 “Product Requirements.”

1.7 OPERATION AND MAINTENANCE MANUALS

A. Submit Operation and Maintenance Manuals for the equipment as specified in Section 01 78 23 “Operational and Maintenance Data.”

PART 2 - PRODUCTS

2.1 RESERVED

PART 3 - EXECUTION

3.1 EXAMINATION AND VERIFICATION

A. Verification of Site Conditions: Contractor shall examine the site(s) and existing facilities and compare them with the Contract Documents with respect to the conditions of the premises, location of or connection of existing facilities and any obstructions which may be encountered and conduct his work to minimize disruption to existing conditions. The costs for making changes to adjust to existing conditions are the responsibility of the Contractor.

3.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling:

1. Obtain the physical sizes of equipment from Manufacturer to ensure that all items will fit in the spaces assigned and instruct the Manufacturers as to the maximum shipping sizes of equipment that can be accommodated at the site.
2. Inspect all equipment and materials against approved Shop Drawings at time of delivery.

B. Storage and Protection:

1. Carefully prepare for storage and label all equipment and materials after they have been inspected.
2. Store all equipment and materials in a dry, covered, ventilated location and protect from harm according to the Manufacturer's instructions.

3.3 INSTALLATION

A. Coordination: Review installation procedures under other Sections and coordinate the installation of items that must be installed with the form work, walls, partitions, ceilings, and those items required to avoid interference with other trade work.

3.4 FIELD QUALITY CONTROL

A. Performance: All Work shall be done by a firm experienced and properly manned and tooled in the Work specified.

3.5 MAINTENANCE

A. The Contractor shall maintain the plumbing system in operating condition until Conditional Acceptance.

3.6 INSTRUCTION PERIOD

A. The Contractor shall furnish the services of the equipment manufacturer's qualified field representative for a period of not less than four hours to instruct plant personnel in the operation and maintenance of the equipment specified hereinbefore, and as specified in Section 01 7900 "Demonstration and Training".

END OF SECTION 220500

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SECTION 22 0517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sleeves without waterstop.
2. Sleeves with waterstop.
3. Sleeve-seal systems.
4. Grout.
5. Silicone sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES WITHOUT WATERSTOP

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends.

B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.

C. Steel Sheet Sleeves: ASTM A653/A653M, 0.0239-inch minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.

2.2 SLEEVES WITH WATERSTOP

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, LLC.
2. CALPICO, Inc.
3. GPT; a division of EnPRO Industries.

4. Metraflex Company (The).

B. Description: Manufactured galvanized steel, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

C. Description: Manufactured, galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, LLC.
2. CALPICO, Inc.
3. GPT; a division of EnPRO Industries.
4. Metraflex Company (The).

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
1. Designed to form a hydrostatic seal of 20 psig minimum.
2. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel, Type 316.
4. Connecting Bolts and Nuts: Stainless steel, Type 316 of length required to secure pressure plates to sealing elements.

2.4 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000 psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Sika Corporation.
b. The Dow Chemical Company.

c. Tremco Incorporated.

2. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, T, NT: Single-component, 100/50, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Sika Corporation.
   b. The Dow Chemical Company.
   c. Tremco Incorporated.
2. Standard: ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 8413 "Penetration Firestopping."

3.2 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout or silicone sealant, seal the space around outside of sleeves.

3.3 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
   2. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

3.5 SLEEVE SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:
   1. Exterior Concrete Walls above and below Grade:
      a. Sleeves with waterstops.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   2. Concrete Slabs-on-Grade:
      a. Sleeves with waterstops.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   3. Concrete Slabs above Grade:
      a. Sleeves with waterstops.
   4. Interior Partitions:
      a. Sleeves without waterstops.

END OF SECTION 22 0517

SECTION 22 0523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bronze ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder-joint connections.
4. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Hand lever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Regular Port and Bronze or Stainless Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE.
g. Stem: Bronze or stainless steel.
h. Ball: Chrome-plated brass or stainless steel.
i. Port: Regular.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.3 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Brass ball valves, two-piece with full port and brass trim.
3. Bronze ball valves, two-piece with full port and bronze or brass trim.

END OF SECTION 22 0523.12

SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal hanger-shield inserts.
4. Fastener systems.
5. Pipe-positioning systems.
6. Equipment supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to "2015 ASME Boiler and Pressure Vessel Code, Section IX."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 THERMAL HANGER-SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless steel.
2. Outdoor Applications: Stainless steel.

C. Adhesive Anchoring Systems: Threaded-zinc-coated or Type 316 stainless steel anchor rod, nut, washer, and adhesive capsule, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE-POSITIONING SYSTEMS

A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.8 MATERIALS

A. Aluminum: ASTM B 221.

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure so as to reduce pipe deflection to within allowable tolerances.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers so as to reduce pipe deflection to within allowable tolerances.
2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
3. Install adhesive anchoring systems in existing concrete. Select anchor based on load carried and embedment depth. Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed. Install anchoring systems according to manufacturer’s written instructions.
4. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

E. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories. Use lock nuts or vibration resistant nuts where potential vibration may cause failure. Install hangers plumb.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts. Do not attach supports to metal decking.

K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.

5. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor. Calculate support loads for installed conditions and for operating or live-loaded conditions, and design supports for the higher load.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 09 9123 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal hanger-shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
10. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30. Use only on trapeze hanger systems or on fabricated frames.
11. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
12. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
13. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
14. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
15. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
16. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
17. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.

18. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
19. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape. Both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles. Provide with an added malleable-iron heel plate or adapter.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes. Both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation. For insulated pipes NPS 4 to NPS 42 when the temperature of the medium is 60 deg F or higher.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors or adhesive anchoring systems instead of building attachments where required in concrete construction.

Q. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 0529

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Warning signs and labels.
2. Pipe labels.
3. Valve tags.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or beaded chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 09 9123 "Interior Painting."

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 20 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Cold Water Piping

   a. Background: Safety green.
   b. Letter Colors: White.

2. Domestic Hot Water Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3. Domestic Hot Water Return and Tempered Water Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

4. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Safety black.
   b. Letter Color: White.

5. Sanitary Vent Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3.2 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 1-1/2 inches, round.
   b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Colors:

   a. Cold Water: Safety green.
   b. Hot Water: Safety green.

3. Letter Colors:

a. Cold Water: White.
b. Hot Water: White.

END OF SECTION 22 0553

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:
   1. Domestic hot-water piping.
   2. Domestic recirculating hot-water piping.
   3. Stormwater piping exposed to freezing conditions.
   4. Roof drains and rainwater leaders
   5. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule" article for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

F. Mineral-Fiber, Preformed Pipe Insulation:
1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Adhesive: As recommended by flexible elastomeric manufacturer and with a VOC content of 80 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Adhesives shall have a VOC content of 80 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Adhesive: As recommended by Adhesive - PVC Jacket manufacturer and with a VOC content of 50 g/L or less.

2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. Mastics: As recommended by insulation manufacturer and with a VOC content of 50 g/L or less.
2. Mastics shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.5 SEALANTS

A. FSK and Metal 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: Aluminum.
5. Sealant shall have a VOC content of 420 g/L or less.
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. 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.

5. Sealant shall have a VOC content of 420 g/L or less.
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
   3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Adhesive: As recommended by jacket material manufacturer.
   2. Color: Color-code jackets based on system. Color as selected by Architect.
   3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
   1. Sheet and roll stock ready for shop or field sizing.
   2. Finish and thickness are indicated in field-applied jacket schedules.
   3. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper OR 2.5-mil-thick polysurlyn.
   4. Factory-Fabricated Fitting Covers:
      a. Same material, finish, and thickness as jacket.
      b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      c. Tee covers.
      d. Flange and union covers.

e. End caps.
f. Beveled collars.
g. Valve covers.
h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor applications.
1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy OR 0.062-inch soft-annealed, stainless steel.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers, Accessible Sinks & Lavatories:
1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures, Accessible Sinks & Lavatories:
1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      a. For below-ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Cleanouts.

3.3 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.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe

insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 9123 "Interior Painting."
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold, Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Stormwater and Overflow:
1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch thick.
   b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   c. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

C. Roof Drain and Overflow Drain Bodies:
1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 1 inch thick.
   b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   c. Mineral Wool, Preformed Pipe Insulation, Type II: 1 inch thick.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be the following:
1. Protective shielding guards.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
1. None.

D. Piping, Exposed:
1. PVC, Color-Coded by System: 30 mils thick.
2. Aluminum, Stucco Embossed: 0.032 inch thick.

END OF SECTION 22 0719

SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Transition fittings.
4. Dielectric fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. Comply with NSF 372 for low lead.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Nipples:

1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F 1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

E. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. Install piping to permit valve servicing.

J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

K. Install piping free of sags and bends.

L. Install fittings for changes in direction and branch connections.

M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

N. Install sleeves for piping penetrations of walls, ceilings, and floors.

O. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 0553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic water piping, NPS 3 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

END OF SECTION 22 1116

SECTION 22 1119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vacuum breakers.
2. Balancing valves.
3. Strainers.
4. Outlet boxes.
5. Drain valves.
6. Water-hammer arresters.
7. Air vents.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:
1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Chrome plated.

2.4 BALANCING VALVES

A. Memory-Stop Balancing Valves:
1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 2 or smaller.
4. Body: Copper alloy.
5. Port: Standard or full port.
6. Ball: Chrome-plated brass.
7. Seats and Seals: Replaceable.
8. End Connections: Solder joint or threaded.
9. Handle: Vinyl-covered steel with memory-setting device.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
   a. Strainers NPS 2 and Smaller: 0.020 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
6. Drain: Factory-installed, hose-end drain valve.

2.6 OUTLET BOXES

A. Clothes Washer/Extractactor Outlet Boxes:
1. Mounting: Recessed.

2. Material and Finish: Enameled-steel or epoxy-painted-steel or Stainless-steel box and faceplate.
3. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
4. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
5. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
6. Inlet Hoses: Two 60-inch- long, heavy duty PVC hose sealed with rigid corrugated outer wall in red-blue and built-in auto shut-off valve and universal 90 degree elbow connection washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
7. Drain Hose: 72-inch- long, heavy duty, industrial grade polypropylene corrugated washer drain hoses with hooked end and clamps.

2.7 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.8 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:
1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.9 AIR VENTS

A. Bolted-Construction Automatic Air Vents:
1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:
   1. Body: Stainless steel.
   2. Pressure Rating: 150-psig minimum pressure rating.
   3. Float: Replaceable, corrosion-resistant metal.
   4. Mechanism and Seat: Stainless steel.
   5. Size: NPS 3/8 minimum inlet.
   6. Inlet and Vent Outlet End Connections: Threaded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install balancing valves in locations where they can easily be adjusted.

B. Install Y-pattern strainers for water on supply side of each control valve.

C. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs.

D. Install water-hammer arresters in water piping according to PDI-WH 201.

E. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test each pressure vacuum breaker according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 ADJUSTING

A. Set field-adjustable flow set points of balancing valves.

END OF SECTION 22 1119

SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Copper tube and fittings.
4. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ANACO-Husky.
b. Charlotte Pipe and Foundry Company.
c. Clamp-All Corp.
d. MIFAB, Inc.
e. Mission Rubber Company, LLC; a division of MCP Industries.
f. NewAge Casting.
g. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C 1277 and ASTM C 1540.

3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

D. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

E. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C 1173.
    b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.
    d. Sleeve Materials:

        1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
        2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
        3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C 1460.
    b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

O. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

    a. Comply with requirements for cleanouts specified in Section 22 1319 "Sanitary Waste Piping Specialties."

2. Install drains in sanitary waste gravity-flow piping.

    a. Comply with requirements for drains specified in Section 22 1319 "Sanitary Waste Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.

3.4 VALVE INSTALLATION

A. Comply with requirements in Section 22 0523.12 "Ball Valves for Plumbing Piping," for general-duty valve installation requirements.

B. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 22 1319 "Sanitary Waste Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

H. Install supports for vertical copper tubing every 10 feet.

I. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Comply with requirements for backwater valves, cleanouts and drains specified in Section 22 1319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Copper Type DWV tube, copper drainage fittings, and soldered joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 and larger shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Copper Type DWV tube, copper drainage fittings, and soldered joints.

    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.

4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

E. Underground, soil, waste, and vent piping NPS 6 and smaller shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 22 1316

SECTION 22 1319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Miscellaneous sanitary drainage piping specialties.

1.2 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
2. Size: Same as connected drainage piping
3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
4. Closure: Countersunk or raised-head, brass or cast-iron plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Closure: Stainless-steel plug with seal.

B. Cast-Iron Exposed Floor Cleanouts:

1. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Heavy-duty, adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Required.

6. Outlet Connection: Spigot.
7. Closure: Brass plug with tapered threads.
8. Adjustable Housing Material: Cast iron with threads.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Round or Square as Scheduled.
11. Top Loading Classification: Heavy Duty.
12. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure Plug:

   a. Cast iron.
   b. Countersunk or raised head.
   c. Drilled and threaded for cover attachment screw.
   d. Size: Same as or not more than one size smaller than cleanout size.

5. Wall Access: 16 by 16-inches square, stainless-steel wall-installation frame and cover, cylinder lock and key, continuous concealed hinge.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

   a. NPS 2: 4-inch-minimum water seal.
   b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Barrier Type Trap Seal Protection Devices (for each floor drain):

1. Basis-of-Design Product: Subject to compliance with requirements, provide SureSeal Manufacturing; Inline Floor Drain Trap Sealer, or a comparable product by one of the following:

a. ProVent Systems, Inc.

2. Standard: ASSE 1072.
3. Body: ASB Plastic.
4. Diaphragm & Sealing Gasket: Neoprene Rubber.
5. Size: 2 inch, 3 inch, 3-1/2 inch, or 4 inch.
6. Gravity Drain Outlet Connection: Compression fit sealing gasket 80 durometer.

E. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Assemble open drain fittings and install with top of hub 1 inch above floor.

E. Install deep-seal traps on floor drains and other waste outlets, if indicated.

F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

H. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

I. Install wood-blocking reinforcement for wall-mounting-type specialties.

J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 22 1316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Comply with requirements in Section 07 6200 "Sheet Metal Flashing and Trim."

B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

3.4 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1319

SECTION 22 1319.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor drains.
2. Floor sinks.
3. Linear shower drains.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg. Co.
b. Josam Company.
c. Zurn Industries, LLC.

2. Standard: ASME A112.6.3.
3. Pattern: Floor or Funnel floor or Sanitary drain as Scheduled.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom or Side.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
11. Sediment Bucket: As Scheduled.
12. Top or Strainer Material: As Scheduled.
13. Top of Body and Strainer Finish: As Scheduled.

14. Top Shape: Shape to match flooring and floor patterns. As Scheduled.
15. Dimensions of Top or Strainer: As Scheduled.
16. Top Loading Classification: Heavy Duty, unless otherwise indicated.
17. Funnel: Required for indirect waste connections.
18. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
19. Trap Material: Cast iron.
20. Trap Pattern: Deep-seal P-trap.
21. Trap Features: Barrier Type Trap Seal Protection Devices.

2.3 FLOOR SINKS

A. Stainless-Steel Floor Sinks, ASME A112.6.7:

1. Standard: ASME A112.6.7.
2. Pattern: Floor drain.
3. Body Material: Stainless steel.
4. Anchor Flange: Required , with seepage holes.
5. Clamping Device: Required.
6. Outlet: Bottom, connection.
7. Sediment Bucket: As scheduled.
8. Internal Strainer: Dome or Flat, as scheduled.
9. Internal Strainer Material: Stainless steel.
10. Top Grate Material: Stainless steel, hinged.
11. Top of Body and Grate Finish: Stainless steel.
12. Top Shape: Shape to match flooring and floor patterns. As scheduled.
13. Top Loading Classification: No traffic.
14. Funnel: Required for indirect waste.

B. Plastic Floor Sinks:

1. Standard: ASME A112.6.7. As Scheduled.
2. Pattern: Floor or Funnel floor drain.
3. Body Material: PVC.
4. Outlet: Bottom, PVC primer and solvent cement connection.
5. Sediment Bucket: As Scheduled.
6. Internal Strainer: Dome or Flat.
7. Internal Strainer Material: PVC.
8. Top Grate Material: Stainless steel. PVC, only where approved.
9. Top Shape: Round or Square.
10. Top Loading Classification: No traffic.
11. Funnel: Required, where Schedule.

2.4 LINEAR SHOWER DRAINS

A. Trench Drains, TD:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Quickdrain, USA, PROLINE REINUOUS DRAIN - PLD36-N or comparable product by one of the following:

a. Pre-Approved Equal.

2. General: Linear floor drain consisting of a formed and welded stainless steel channel body and cover that can be easily adjusted to tile or stone covering thicknesses from 1/8 inch to 1 inch. Provide custom spacers if floor finish is greater than 1 inch. Fully sloped drain body trough to prevent standing water and solids being deposited in the trough. ADA compliant.
3. Material: 18-gauge Stainless Steel 316 L.
4. Flange: Bonding flange for liquid waterproofing attachment.
5. Clamping Device: Not required.
6. Outlet: Bottom.
7. Grate Material: Stainless steel.
8. Cover Design: As selected by Architect.
9. Dimensions of Frame and Grate: 36 inches total length. As Scheduled or Shown on Drawings.
10. Accessories: Levelling and placement brackets. Curb covers
11. Top Loading Classification: Medium Duty.
12. Trap Material: Cast iron.
13. Trap Pattern: Deep seal P-trap.
14. Trap Features: Barrier Type Trap Seal Protection Devices.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install open drain fittings with top of hub 1 inch above floor.

C. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.

2. Assemble channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
3. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.
4. Embed channel sections and drainage specialties in 4-inch (102-mm) minimum concrete around bottom and sides.
5. Fasten grates to channel sections if indicated.
6. Assemble channel sections with flanged or interlocking joints.

3.2 CONNECTIONS

A. Comply with requirements in Section 22 1316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 22 1319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

C. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 1319.13

SECTION 22 1414 - STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Specialty pipe fittings.

1.3 QUALITY ASSURANCE

A. Provide materials bearing label, stamp, or other markings of specified testing agency.

1.4 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation are to be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

2.2 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AB & I Foundry; a part of the McWane family of companies.
2. Charlotte Pipe and Foundry Company.
3. Tyler Pipe; a part of McWane family of companies.

B. Pipe and Fittings:

1. Marked with CISPI collective trademark and NSF certification mark.
2. Standard: ASTM A74.
3. Class: Service weight cast iron.

C. Gaskets: ASTM C564, rubber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AB & I Foundry; a part of the McWane family of companies.
2. Charlotte Pipe and Foundry Company.
3. Tyler Pipe; a part of McWane family of companies.

B. Pipe and Fittings:

1. Marked with CISPI collective trademark and NSF certification mark.
2. Standards: ASTM A888 and CISPI 301.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Standard: ASTM C1277 or ASTM C1540.
2. Description: Stainless steel shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.

3. Shielded, Nonpressure Transition Couplings:

    a. Standard: ASTM C1460.
    b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.

4. Dielectric Nipples:
    a. Description: Electroplated steel nipple.
    b. Standards: ASTM F492, ASME B1.20.1.
    c. Pressure Rating: 300 psig at 225 deg F.
    d. End Connections: Male threaded or grooved.
    e. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 2300 “Excavating, Filling, and Grading."

3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

B. Install piping as indicated unless deviations from layout are approved on coordination drawings.

C. Install piping in concealed locations.

1. Piping installed in equipment rooms, service areas, and where indicated may be exposed.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.

1. Do not change direction of flow more than 90 degrees.
2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install piping at the following minimum slopes unless otherwise indicated.

1. Building Storm Drain: 1/4 inch per foot downward in direction of flow for piping NPS 3 and smaller; 1/8 inch per foot downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Storm Drainage Piping: 1/4 inch per foot downward in direction of flow.

M. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Ch IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping.

    a. Comply with requirements for backwater valves specified in Section 22 1423 "Storm Drainage Piping Specialties."

2. Install cleanouts in storm drainage gravity-flow piping in accessible locations.

    a. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
    b. Comply with requirements for cleanouts specified in Section 22 1423 "Storm Drainage Piping Specialties."

3. Install drains in storm drainage gravity-flow piping.

a. Comply with requirements for drains specified in Section 22 1423 "Storm Drainage Piping Specialties."

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 22 0517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hubless, Cast-Iron Soil Piping Coupled Joints: Join in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
c. Do not use pipe sections that have cracked or open welds.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.4 INSTALLATION OF SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Drainage Piping: Shielded, nonpressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for cast-iron piping with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical cast-iron piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent, but as a minimum at base and at each floor.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
2. Install horizontal backwater valves with cleanout cover flush with floor.

3. Comply with requirements for backwater valves cleanouts and drains specified in Section 22 1423 "Storm Drainage Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections in accordance with the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed storm drainage piping.

B. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved.

a. Expose work that was covered or concealed before it was tested.

3. Test Procedure:

a. Test storm drainage piping, except outside leaders, on completion of roughing-in.
b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
c. From 15 minutes before inspection starts until completion of inspection, water level must not drop.
d. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

3.10 PROTECTION

A. Protect piping and drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day and when work stops.

C. Repair damage to adjacent materials caused by storm drainage piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller is to be any of the following:

1. Service weight, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Underground storm drainage piping NPS 6 and smaller is to be the following:

1. Service weight, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Underground, storm drainage piping NPS 8 and larger is to be the following:

1. Service weight, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 22 1414

SECTION 22 1423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General-purpose roof drains.
2. Miscellaneous storm drainage piping specialties.
3. Cleanouts.
4. Backwater valves.

B. Related Requirements:

1. Section 07 6200 "Sheet Metal Flashing and Trim" for penetrations of roofs.
2. Section 07 8413 "Penetration Firestopping" for firestopping roof penetrations.

1.2 ACTION SUBMITTALS

A. Product Data:

1. General-purpose roof drains.
2. Miscellaneous storm drainage piping specialties.
3. Cleanouts.
4. Backwater valves.

1.3 QUALITY ASSURANCE

A. Provide drainage piping specialties are to bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 GENERAL-PURPOSE ROOF DRAINS

A. Cast-Iron Roof Drains.

1. Cast-Iron, Large-Sump, General-Purpose Roof Drains: RD.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Jay R. Smith Mfg Co; a division of Morris Group International.
2) MIFAB, Inc.
3) WATTS; A Watts Water Technologies Company.
4) Wade; a subsidiary of McWane Inc.
5) Zurn Industries, LLC.

b. Standard: ASME A112.6.4.
c. Body Material: Cast iron.
d. Dimension of Body: Nominal 14-to 16-inch diameter.
e. Dome Material: Aluminum.
f. Combination flashing ring and gravel stop.
g. Outlet: Bottom.
h. Outlet Type: No-hub.
i. Options:
1) Extension collars.
2) Underdeck clamp.
3) Expansion joint.
4) Sump receiver plate.
5) Perforated Gravel Guard: Stainless steel.
6) Vandal-proof dome.

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Adapters: .

1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior sheet metal downspout.
2. Size: Inlet size to match parapet drain outlet.

B. Downspout Boots: .

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. WATTS; A Watts Water Technologies Company.
c. Wade; a subsidiary of McWane Inc.
d. Zurn Industries, LLC.

2. Description: Manufactured, ASTM A48/A48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
3. Size: Inlet size to match downspout and NPS 4 outlet.

C. Metal Downspout Nozzles: .

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. WATTS; A Watts Water Technologies Company.
c. Wade; a subsidiary of McWane Inc.
d. Zurn Industries, LLC.

2. Description: Nozzle with wall flange and mounting holes to cover rough opening and serve as anchor.
3. Size: Same as connected downspout.
4. Material: Cast bronze or nickel bronze nozzle and flange.
5. Piping Connection Type: Threaded or No-hub or slip on.
6. Finish: As Scheduled..
7. Opening Protection: Birdscreen.

2.3 CLEANOUTS

A. Cast-Iron Cleanouts.

1. Cast-Iron Exposed Cleanouts: .

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Jay R. Smith Mfg Co; a division of Morris Group International.
2) MIFAB, Inc.
3) WATTS; A Watts Water Technologies Company.
4) Wade; a subsidiary of McWane Inc.
5) Zurn Industries, LLC.

b. Standard: ASME A112.36.2M.
c. Size: Same as connected branch.
d. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
e. Closure: Countersunk or raised-head Raised head, brass plug.
f. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

2. Cast-Iron Exposed Floor Cleanouts: .

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Jay R. Smith Mfg Co; a division of Morris Group International.
2) WATTS; A Watts Water Technologies Company.
3) Wade; a subsidiary of McWane Inc.
4) Zurn Industries, LLC.

b. Standard: ASME A112.36.2M.
c. Size: Same as connected branch.

d. Type: Heavy-duty, adjustable housing.
e. Body or Ferrule: Cast iron.
f. Outlet Connection: Hub with gasket.
g. Closure: Brass plug with tapered threads.
h. Adjustable Housing Material: Cast iron with threads.
i. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
j. Frame and Cover Shape: Square.
k. Top Loading Classification: Extra-Heavy Duty.
l. Riser: ASTM A74, Extra-Heavy Class, cast-iron drainage pipe fitting and riser to cleanout.
m. Options:

1) Clamping device.

3. Cast-Iron Wall Cleanouts: .

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Jay R. Smith Mfg Co; a division of Morris Group International.
2) MIFAB, Inc.
3) WATTS; A Watts Water Technologies Company.
4) Wade; a subsidiary of McWane Inc.
5) Zurn Industries, LLC.

b. Standard: ASME A112.36.2M. Include wall access.
c. Size: Same as connected drainage piping.
d. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
e. Closure Plug:

1) Material: Brass.
2) Head: Countersunk or raised.
3) Drilled and threaded for cover attachment screw.
4) Size: Same as, or not more than, one size smaller than cleanout size.

f. Wall-Access Frame and Cover: Square, stainless steel wall-installation frame and cover.

4. Cast-Iron Test Tees: .

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Jay R. Smith Mfg Co; a division of Morris Group International.
2) MIFAB, Inc.
3) WATTS; A Watts Water Technologies Company.
4) Zurn Industries, LLC.

b. Standard: ASME A112.36.2M and ASTM A74, ASTM A888, or CISPI 301.

c. Size: Same as connected drainage piping.
d. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or no-hub, cast-iron soil-pipe test tee as required to match connected piping.
e. Closure Plug: Countersunk or raised head, brass.
f. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

2.4 BACKWATER VALVES

A. Cast-Iron Backwater Valves.

1. Cast-Iron, Horizontal Backwater Valves: .

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Jay R. Smith Mfg Co; a division of Morris Group International.
2) MIFAB, Inc.
3) WATTS; A Watts Water Technologies Company.
4) Wade; a subsidiary of McWane Inc.
5) Zurn Industries, LLC.

b. Standard: ASME A112.14.1.
c. Size: Same as connected piping.
d. Body Material: Cast iron.
e. Cover: Cast iron with bolted or threaded to access check valve.
f. End Connections: Hub and spigot or no-hub.
g. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
h. Extension: ASTM A74, Service Class; full-size, cast-iron soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains in accordance with roof membrane manufacturer's written installation instructions at low points of roof areas.

1. Install flashing collar or flange of roof drain to maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.

B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.

C. Install downspout boots at grade with top 18 inches above grade. Secure to building wall.

D. Install downspout nozzles at exposed bottom of conductors where they spill onto grade.

E. Install cleanouts in aboveground piping and building drain piping in accordance with the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at minimum intervals of 50 ft. for piping NPS 4 and smaller and 100 ft. for larger piping.
4. Locate cleanouts at base of each vertical storm piping conductor.

F. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

H. Install horizontal backwater valves in floor with cover flush with floor.

I. Install drain-outlet backwater valves in outlet of drains.

J. Install test tees in vertical conductors and near floor.

K. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

L. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.

M. Install through-penetration firestop assemblies for penetrations of fire- and smoke-rated assemblies.

1. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 22 1414 "Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 INSTALLATION OF FLASHING

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

3.4 CLEANING

A. Clean piping specialties during installation and remove dirt and debris as work progresses.

3.5 PROTECTION

A. Protect piping specialties during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day and when work stops.

END OF SECTION 22 1423

SECTION 22 4213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than three of each type.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets WC-1, WC-1A: Floor mounted, bottom outlet, top spud.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. American Standard.
   b. Kohler Co.
   c. Sloan Valve Company.
   d. TOTO USA, INC.

2. Bowl:

   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height:
      1) WC-1: Standard
      2) WC-1A: Handicapped/elderly, complying with ICC/ANSI A117.1.
   f. Rim Contour: Elongated.
   g. Water Consumption: 1.28 gal. per flush.
   h. Spud Size and Location: NPS 1-1/2; top.
   i. Color: White.

3. Bowl-to-Drain Connecting Fitting: ASTM A1045 or ASME A112.4.3.
4. Flushometer Valve: WFV-1. Bumper on Angle Stop for open seat without cover.
5. Toilet Seat: TS-1.

2.2 WALL-MOUNTED WATER CLOSETS

A. Water Closets WC-2: Wall mounted, top spud.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. American Standard.
   b. Kohler Co.
   c. Sloan Valve Company.
   d. TOTO USA, INC.

2. Bowl:

   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.

b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Flushometer valve.
e. Height:
1) WC-2: Standard
f. Rim Contour: Elongated.
g. Water Consumption: 1.28 gal. per flush.
h. Spud Size and Location: NPS 1-1/2; top.
i. Color: White.

3. Bowl-to-Drain Connecting Fitting: ASTM A1045 or ASME A112.4.3.
4. Flushometer Valve: WFV-1. Bumper on Angle Stop for open seat without cover.
5. Toilet Seat: TS-1.
6. Support: High Performance, Adjustable Siphon Jet Water Closet Carriers.

a. Standard: ASME A112.6.1M.
b. Load Rating: Heavy Duty = 750 lbs .
c. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, cast iron couplings, gaskets, 2" vent, and feet; bolts and hardware matching fixture.[Include additional extension coupling, faceplate, rear anchor tie-down, and feet for installation in wide pipe space.]
d. Water-Closet Mounting Height: [Standard for WC-1.] [**Child**] [Handicapped/elderly according to ICC/ANSI A117.1 for WC-1A].
e. Coupling/Waste Orifice Diameter: 3 in.
f. Foot Type: Universal (standard or pre-fab installations).
g. Material: Cast Iron.
h. Auxiliary foot support. Flush Valve Supply Support for Water Closets.

2.3 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves WFV-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.
a. American Standard.
b. Kohler Co.
c. Sloan Valve Company.
d. TOTO USA, INC.

2. Standard: ASSE 1037. WaterSense Listed.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Consumption: 1.28 gal. per flush.
10. Minimum Inlet: NPS 1.
11. Minimum Outlet: NPS 1-1/4.

2.4 TOILET SEATS

A. Toilet Seats TS-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Standard America.
   b. Bemis Manufacturing Company.
   c. Church Seats; Bemis Manufacturing Company.
   d. Kohler Co.
   e. Olsonite Seat Co.
   f. TOTO USA, INC.
   g. Zurn Industries, LLC.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4213.13

SECTION 22 4216.13 - COMMERCIAL LAVATORIES

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. Lavatories.
2. Faucets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

A. Lavatory L-1 & L-1A: Oval, self-rimming, vitreous china or solid surface, undercounter mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard America.
b. Crane Plumbing, L.L.C.
c. Gerber Plumbing Fixtures LLC.
d. Kohler Co.
e. Sloan Valve Company.
f. TOTO USA, INC.
g. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1. ADA Compliant.
b. Type: Self-rimming for under-counter mounting. Coordinate with Architectural Division for exact dimensions. One piece solid surface deck with integral basins, and slab dimensions indicated on Architectural plans. Provide unit complete with commercial heavy duty, concealed floor mounted arm/carrier. Provide single drilled hole for each basin for offset faucet. Coordinate with Architect for exact location of faucet mounting, where Architect provides solid surface material sink and counter,
c. Nominal Size: Oval, 20 by 14 inches.
d. Faucet-Hole Punching: Three holes, 2-inch centers.
e. Faucet-Hole Location: on countertop.
f. Color: White.
g. Mounting Material: Sealant and undercounter mounting kit.

3. Faucet: F-1 Solid-Brass, Manually Operated Faucets".

2.2 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF 372 for faucet materials that will be in contact with potable water.

B. Lavatory Faucets F-1: Manual-type, two-handle mixing, commercial, solid-brass valve.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Moen model 8210SMF12 or comparable product by one of the following:

a. Moen Incorporated.

2. Standard: ASME A112.18.1/CSA B125.1. Watersense Certified. ADA compliant.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Type: Centerset.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 0.5 gpm (1.5 L/min.).
8. Mounting Type: Deck, exposed.
9. Valve Handle(s): Wrist levers, 4-inches.
10. Spout: Rigid type.
11. Spout Outlet: Laminar flow.
12. Operation: Compression, manual.
13. Drain: Grid.

2.3 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout-outlet materials that will be in contact with potable water.

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. AM Conservation Group, Inc.
2. Chronomite Laboratories, Inc.; a division of Acorn Engineering Company.
3. NEOPERL, Inc.

C. Description: Chrome-plated-brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2.
2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 0719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4216.13

SECTION 22 4216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service sinks.
2. Manually operated sink faucets.
3. Supply fittings.
4. Grout.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics and furnished specialties and accessories.

PART 2 - PRODUCTS

2.1 SERVICE SINKS

A. Service Sinks - Enameled Cast Iron, Trap Standard Mounted: MB-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. American Standard.
   b. Kohler Co.
   c. Zurn Industries, LLC.

2. Source Limitations: Obtain sinks from single source from single manufacturer.
3. Fixture:

   a. Standard: ASME A112.19.1/CSA B45.2.
   b. Type: Service sink with back.
   c. Back: Two faucet holes.
   d. Nominal Size: 24 by 20 inches.
   e. Color: White.

f. Mounting: NPS 3 P-trap standard with grid strainer inlet, cleanout, and floor flange.
g. Rim Guard: On front and sides.

4. Faucet: SSF-1 service sink faucet designation from "Manually Operated Sink Faucets" Article.
5. Support: Sink carrier.

2.2 MANUALLY OPERATED SINK FAUCETS

A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Commercial Service Sink Faucets - Manual Type: SSF-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard.
b. Chicago Faucets; Geberit Group.
c. Kohler Co.
d. Speakman Company.
e. T&S Brass and Bronze Works, Inc.

2. Source Limitations: Obtain sink faucets from single source from single manufacturer.
3. Description: Wall/back mounted, brass body, with integral service stops, checks, spout with bucket/pail hook, 3/4-inch hose thread end, integral vacuum breaker, inlets 8 inches o.c., and two-handle mixing.
4. Faucet:

a. Standards:

1) ASME A112.18.1/CSA B125.1.
2) NSF 61 and NSF 372.
3) ICC A117.1.
4) ASSE 1001 (VB).

b. Finish: Rough chrome plated.
c. Handles: 4-inch wrist blade.
d. Cartridges: One-fourth turn compression.
e. Brace: Adjustable top brace.

5. Vacuum Breaker: Required for hose outlet.
6. Spout Outlet: Hose thread in accordance with ASME B1.20.7.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.

F. Risers:

1. NPS 1/2.
2. Chrome-plated, rigid-copper pipe.

2.4 GROUT

A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000 psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb in accordance with rough-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Set floor-mounted sinks in leveling bed of cement grout.

D. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 22 0523.12 "Ball Valves for Plumbing Piping" and Section 22 0523.15 "Gate Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 0500 "Common Work Results for Plumbing."

F. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."

G. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 22 0719 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4216.16

SECTION 22 4223 - COMMERCIAL SHOWERS

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. Individual showers.
2. Shower faucets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower faucets to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 INDIVIDUAL SHOWERS

A. Individual Showers SH-1 & SH-1A:

1. General: Accessible, shower enclosure with faucet and receptor and appurtenances. Refer to Architectural drawings and specifications.
2. Faucet: SHF-1 for SH-1 and SHF-1A for SH-1A.
3. Outlet: Grid drain with NPS 3 outlet. Center location.
4. Warranty: Manufacturer's standard five years.

2.2 SHOWER FAUCETS

A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.

B. Source Limitations: Obtain each type of plumbing fixture and compatible accessories through one source from a single approved manufacturer.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" ; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

D. Water Flow and Consumption Requirements: Comply with Public Law 102-486 "Energy Policy Act."

E. Shower Faucets SHF-1:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley faucet model as Scheduled on Drawings.
2. Description: Single-handle, heavy-duty thermostatic/pressure-balancing mixing valve with hot- and cold-water indicators; check stops; and shower head.
3. Faucet:

    a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016. Water Sense Certified.
    b. Body Material: Solid brass.
    c. Finish: ASTM A 480/A 480M, No. 4 polished chrome finish on exposed surfaces.
    d. Maximum Flow Rate: 1.5 gpm unless otherwise indicated.
    e. Mounting: Concealed.
    f. Operation: Single-handle, twist or rotate control with battery powered digital LCD temperature display for outlet water temperature in 40 – 120 deg. F or 4 – 49 deg. C.
        1) Temperature handle to operate counterclockwise through 270-degree arc, with off at 6 o'clock position and maximum hot at 9 o'clock position.
        2) Adjustable temperature limit stop to limit handle travel in hot direction.
        3) Pressure-balancing mechanism maintains selected discharge temperature to plus or minus 2 degrees F.
    g. Antiscald Device: Integral with mixing valve.
    h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
    i. Showerhead Anchor Plate: 3/16-inch cadmium-plated steel plate with countersunk mounting holes and machine screws provide additional mounting length.
    j. Showerhead Back Plate: 3/16-inch cadmium-plated steel plate furnished with couplings, studs and nuts allows most secure anchorage of wall-mounted components.

4. Supply Connections: NPS 1/2.

5. Shower Head:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Type: Ball joint with arm and flange.
c. Shower Head Material: Metallic with chrome-plated finish.
d. Spray Pattern: Adjustable .
e. Integral Volume Control: Not required.
f. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
g. Temperature Indicator: Not required.

F. Shower Faucets SHF-1A:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bradley faucet model as Scheduled on Drawings.
2. Description: Single-handle, heavy-duty pressure-balance mixing valve with hot- and cold-water indicators; check stops; and hand-held shower system.
3. Faucet:

a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016. Water Sense Certified.
b. Body Material: Solid brass.
c. Finish: Polished chrome finish on exposed surfaces.
d. Maximum Flow Rate: 1.5 gpm unless otherwise indicated.
e. Mounting: Concealed.
f. Operation: Single-handle, twist or rotate control.
1) Lever-style handle with battery powered digital LCD temperature display on escutcheon.
2) Temperature handle to operate counterclockwise through 270-degree arc, with off at 6 o'clock position and maximum hot at 9 o'clock position.
3) Adjustable temperature limit stop to limit handle travel in hot direction.
4) Pressure-balancing mechanism maintains selected discharge temperature to plus or minus 2 degrees F.
g. Antiscald Device: Integral with mixing valve. Brass cartridge with stainless steel materials.
h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
i. Showerhead Anchor Plate: 3/16-inch cadmium-plated steel plate with countersunk mounting holes and machine screws provide additional mounting length.
j. Showerhead Back Plate: 3/16-inch cadmium-plated steel plate furnished with couplings, studs and nuts allows most secure anchorage of wall-mounted components.

4. Supply Connections: NPS ½.

5. Hand Shower:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Type: Hose with vandal-resistant, hand-held head with quick disconnect, wall hooks, and bracket. Glide rail not acceptable.
c. Shower Head Material: Metallic with chrome-plated finish and swivel connections. 60 to 80-inches double spiral expandable chrome plated or stainless steel metal hose.
d. Spray Pattern: Fixed.
e. Integral Volume Control: Required.
f. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
g. Temperature Indicator: Not required.
h. Vacuum Breaker: In-line backflow preventer, chrome plated, NPS 1/2.

6. Shower Head:

   a. Standard: ASME A112.18.1/CSA B125.1.
   b. Type: Ball joint with arm and flange.
   c. Shower Head Material: Metallic with chrome-plated finish.
   d. Spray Pattern: Multi-Jet.
   e. Integral Volume Control: Not required.
   f. Shower-Arm, Flow-Control Fitting: 1.5 gpm.
   g. Temperature Indicator: Not required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.

B. Examine walls and floors for suitable conditions where showers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions. Provide blocking for shower accessories/appurtenances that are not being supplied by shower manufacturer. Install per manufacturer's written instructions.

B. Install showers level and plumb according to roughing-in drawings.

C. Install water-supply piping with stop on each supply to each shower faucet.

   1. Exception: Use ball valves if supply stops are not specified with shower. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping."
   2. Install stops in locations where they can be easily reached for operation.

D. Install shower flow-control fittings with specified maximum flow rates in shower arms.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

F. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with traps and soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Curtain Adjustment: After hanging curtains, test and adjust each track or rod to produce unencumbered, smooth operation. Steam and dress down curtains as required to produce crease- and wrinkle-free installation. Remove and replace curtains that are stained or soiled or that have stress points or diagonal folds.

3.5 CLEANING AND PROTECTION

A. After completing installation of showers, inspect and repair damaged finishes.

B. Clean showers, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of showers for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4223

SECTION 22 4716 - PRESSURE WATER COOLERS

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. Pressure water coolers.
2. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler and bottle filling station.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include diagrams for power wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers and bottle filling stations to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: Equal to 20 percent of quantity installed for each type and size indicated, but no fewer than two of each.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Pressure water coolers and bottle filling stations intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 or NSF 372, or be certified in compliance with NSF 61 or NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
2. Comply with ASHRAE 34 for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.
3. Comply with UL 399.
4. Comply with ASME A112.19.3/CSA B45.4.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Comply with NSF 42 and NSF 53 for water filters for water coolers and bottle filling stations.
7. Comply with ICC A117.1 for accessible water coolers and bottle filling stations.

2.2 PRESSURE WATER COOLERS

A. Pressure Water Coolers - Surface Wall-Mounted, Vinyl-Covered Metal with Stainless Steel Top: EWC-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Elkay model LZSTLLG8WSLK or comparable product by one of the following:

    a. Elkay.
    b. Halsey Taylor.

2. Source Limitations: Obtain surface wall-mounted, vinyl-covered metal with stainless steel top, pressure water coolers from single source from single manufacturer.
3. Type: Vandal resistant.
4. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
5. Control: Electronic front and side bubbler push bar.
6. Bottle Filler: Sensor activation, with 20-second automatic shutoff timer: Fill rate 0.5 to 1.5 gpm. Mount above lower side water cooler. Green ticker to inform user of number of 20 oz. plastic water bottles saved from waste. Laminar flow provides clean fill with minimal splash.
7. Drain: Grid with NPS 1-1/4 tailpiece.
8. Supply: NPS 3/8 with shutoff valve.
9. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
10. Filter: One or more water filters with capacity sized for unit peak flow rate.

a. Visual Filter Monitor: LED Filter Status Indicator for when filter change is necessary.
b. Filter certified to NSF 42 and 53 for lead, cyst, particulate, chlorine, taste and odor reduction. 3,000 gal. capacity.
c. Elkay WaterSentry Replacement Filter (Bottle Fillers & Liv Pro)

11. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat. Five years warranty.
12. Support: Water-cooler carrier.
13. Water-Cooler Mounting Height: High/low - standard/accessible in accordance with ICC A117.1. Provide cane apron.
14. Capacities and Characteristics:

a. Cooled Water: 8 gph.
b. Ambient-Air Temperature: 90 deg F.
c. Inlet-Water Temperature: 80 deg F.
d. Cooled-Water Temperature: 50 deg F.
e. Cooled-Water Storage: None.
f. Electrical Characteristics:

1) Motor Horsepower: 360 watts.
2) Volts: 120 V ac.
3) Phase: Single.
4) Hertz: 60 Hz.
5) Full-Load Amperes: 6 A.
6) Maximum Overcurrent Protection: 20 A.

2.3 SUPPORTS

A. Water-Cooler Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Josam Company.
c. MIFAB, Inc.
d. Wade; a subsidiary of McWane Inc.
e. Zurn Industries, LLC.

2. Standard: ASME A112.6.1M.
3. In-wall Carrier for Bi-level On-wall Bottle Fillers Coolers & Fountains

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

C. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers, and bottle filling stations to mounting frames.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 22 0523.12 "Ball Valves for Plumbing Piping"

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings.

G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 9200 "Joint Sealants."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 1116 "Domestic Water Piping."

C. Install ball shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 22 0523.12 "Ball Valves for Plumbing Piping"

D. Comply with soil and waste piping requirements specified in Section 22 1316 "Sanitary Waste and Vent Piping."

3.4 ELECTRICAL CONNECTIONS

A. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."

B. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

C. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplates to be laminated acrylic or melamine plastic signs, as specified in Section 26 0553 "Identification for Electrical Systems."
2. Nameplates to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.6 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4716

SECTION 23 0500 - GENERAL HVAC REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION

A. Section includes general administrative and procedural requirements for HVAC work. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:

1. Submittals.
2. Coordination drawings.
3. Record documents.
4. Operation and Maintenance manuals.
5. Rough-ins.
6. Mechanical installations.
7. Electrical Requirements for Mechanical Equipment.
8. Mechanical sleeve seals.
9. Sleeves.
10. Escutcheons.
11. Grout.
12. HVAC demolition.
13. Equipment installation requirements common to equipment sections.
14. Painting and finishing.
15. Concrete bases.
16. Supports and anchorages.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. HVAC: Heating, Ventilating and Air Conditioning.

G. System Installer: An entity (firm), identified by the Contractor and approved as qualified by the Owner, designated to perform HVAC system installation duties as described herein.

1.04 SUBMITTALS

A. Shop drawings shall be submitted for all items specified herein in accordance with Section 01 3300 “Submittal Procedures”. Shop drawings shall include, but not be limited to, physical characteristics, parts and materials lists, electrical characteristics, operating data, dimensional drawings, wiring diagrams, weights, and installation requirements, such as, but not limited to:

B. General: Follow the procedures specified in the General and Supplementary Conditions, and individual Division 23 Sections.

1. Edit manufacturer's standard dimension drawings, performance and product data by deleting reference to equipment, features or information which is not applicable to the product being supplied for this project.

2. Provide sufficient copies of submittals, with the Engineer’s submittal review stamp for inclusion in the Operation and Maintenance Manuals.

C. Product Data: For each type of products and materials.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

E. Wiring Diagrams: For power, signal, and control wiring.

F. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to minimum scale of ¼” = 1’-0” or larger. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, process mechanical, mechanical, and electrical systems.

b. Indicate required installation sequences.

c. Indicate reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

d. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

e. Indicate detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1) Indicate the proposed locations of piping, ductwork, equipment, and materials. Including but not limited to the following:

a) Clearances for installing and maintaining insulation.

b) Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

c) Equipment service connections and support details.

d) Exterior wall and foundation penetrations.

e) Fire-rated wall and floor penetrations.

f) Smoke-rated wall penetrations.

g) Sizes and location of required concrete pads and bases.

h) Valve stem movement.

2) Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3) Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

a) Include planned duct systems layout, including elbow radii and duct accessories.

b) Include planned piping layout, including valve and specialty locations.

2. Sheet Size: At least 11 by 17 inches but no larger than 24 by 36 inches.

3. Number of Copies: Submit four opaque copies of each submittal. Engineer will return one copy.

   a. Submit five copies where Coordination Drawings are required for operation and maintenance manuals. Engineer will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.

4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

5. Schedule: Refer to Division 1.

G. If the coordination drawings submitted are not approved in accordance with their requirements, the Owner will not review and approve additional partial payment requests until such time as the coordination drawings submittals are brought into compliance.

H. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

I. Warranty: Special warranty specified in this Section.

J. Welding certificates.

K. Permits.

L. Qualification Data: For qualified Installer, manufacturer, fabricator, professional, testing agency, and factory-authorized service representative.

M. Calculations.

N. Operation and Maintenance Manuals: For each HVAC systems, subsystems, or equipment to include in emergency, operation, and maintenance manuals.

1. Prepare operation and maintenance manuals in accordance with the requirements in General Conditions, Division 1 Sections and ASHRAE Guideline 4 “Preparation of operating and Maintenance Documentation for Building Systems.” In addition to the requirements specified in above references, include the following:

   a. Include for equipment items:

      1) Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

      2) 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.

3) Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4) Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

5) Servicing instructions and lubrication charts and schedules.

6) Spare Parts Lists: Include a recommended spare parts list for all equipment furnished for the project. The parts list must include a tabulation of descriptive data for all the electrical-electronic spare parts and all the mechanical spare parts proposed for each type of equipment or system. Each part must be properly identified by part number and manufacturer.

7) Test reports for all field and factory tests performed.

8) Start-up reports for all start-up work performed.

9) Warranties and guarantees.

a) List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

10) Contractor's, Supplier's, and Local representative's name, address, telephone number, and contact person.

b. Material Safety Data Sheets (MSDS).

c. Refer to other Division 23 sections for additional requirements for Operation and Maintenance Manuals, Operating Instructions, Training and other deliverables.

2. Posted Operating Instructions:

a. General: Prepare operating instructions and diagrams for posting near the equipment. Posted operating instructions must be photographic or equal non-fading reproductions framed under glass or encased in non-discoloring plastic and shall be mounted in locations as directed. Include and use copies of the posted operating instructions with the operating and maintenance manuals as a basis for training Owner's employees in the operation and maintenance of systems and related

equipment installed under contract at the facility.

b. Posted operating instructions shall consist of simplified, consolidated equipment, control, and power diagrams graphically representing the entire system and actual equipment installed, including concise written instructions on how to start and stop systems, what settings and conditions are to be observed, and what control adjustments are to be made or maintained by the operation. Posted operating instructions shall include, but are not limited to the following:

1) Heating, ventilating, and air-conditioning controls for each system.

2) Ventilation systems controls.

3) One-line diagrams of refrigerant piping systems, including risers, main shutoff valves, and the like.

O. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On magnetic media or compact disk, complete with data files.

3. Device address list.

4. Printout of software application and graphic screens.

P. Record Documents:

1. Prepare record documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, 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 of HVAC Piping and Equipment."

c. Indicate actual invert elevations and horizontal locations of underground equipment, piping and ductwork.

d. Indicate actual elevations and horizontal locations of aboveground equipment, piping and ductwork.

e. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

f. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

g. Refer to other Division 23 sections for additional requirements.

2. Record Drawings:

a. Drawings showing final as-built conditions of the project. The final CADD as-built drawings shall consist of one set of electronic CADD drawing files in the specified format, one set of Mylar drawings, 2 sets of blue-line prints of the mylars, and one set of the approved working as-built drawings unless otherwise indicated. Documents shall not be copyrighted.

b. Only personnel proficient in the preparation of CADD drawings shall be employed to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings shall be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols shall be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, they shall be prepared using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final as-built drawings shall be identical to that used on the contract drawings. Additions and corrections to the contract drawings shall be accomplished using CADD files. The Contractor shall use AUTOCAD Release 2016 software and a Windows 10 operating system. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). The Contractor shall be responsible for providing all program files and hardware necessary to prepare final as-built drawings. The Architect will review final as-built drawings for accuracy and the Contractor shall make required corrections, changes, additions, and deletions.

1) CADD colors shall be the "base" colors of red, green, and blue. Color code for changes shall be as follows:

a) Deletions (red) - Deleted graphic items (lines) shall be colored red with red lettering in notes and leaders.

b) Additions (Green) - Added items shall be drawn in green with green lettering in notes and leaders.

c) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes shall be in blue.

3. As-Built Record of Equipment and Materials: Copies of the record listing the as-built materials and equipment incorporated into the construction of the project.

1.05 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1,

"Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

D. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics, capacities, and ratings than the basis of design may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, bases, equipment spaces, and conduit sizes are appropriately modified. No additional costs will be approved for these modifications, if equipment is approved. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

E. The Contractor shall be responsible for any and all deviations from the construction documents. The Contractor, at his/her expense, shall coordinate and provide all modifications associated with deviations, including approved alternates and manufacturers, from the basis of design. Any deviation affecting structural systems shall require the approval and the stamp of a professional structural engineer.

F. NRCA Compliance: Roof accessories shall be constructed according to recommendations of NRCA.

G. Reference Standards: Comply with all Federal, State and City laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below. In case of a conflict between standards, the more stringent shall be followed.

1. Associated Air Balance Council.
2. American Conference of Governmental Industrial Hygienist (ACGIH). Industrial Ventilation: A Manual of Recommended practices (latest edition).
3. Air Movement and Control Association (AMCA).
4. American National Standards Institute (ANSI)
5. Air Conditioning, Heating and Refrigeration Institute (AHRI)
6. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). Handbook Series (latest editions).
7. American Society of Plumbing Engineers (ASPE)
8. American Society for Testing and Materials (ASTM)
9. American Welding Society (AWS)
10. American Water Works Association (AWWA)

11. International Building Code/ 2015, International Plumbing Code/ 2015, International Mechanical Code/2015, International Fire Prevention Code/2015, International Fuel Gas Code/2015, International Energy Conservation Code/2015, and International Green Building Code/2012 as amended by State of Maryland and other regulatory agencies having jurisdiction.
12. All applicable provisions of the State of Maryland "Maryland Building Performance Standards (MBPS)."
13. Midwest Insulation Contractors' Association, Inc. (MICA)
14. Manufacturers' Standardization Society (MSS)
15. National Environmental Balancing Bureau (NEBB)
16. NEC, National Electric Code as amended by the State of Maryland and other regulatory agencies having jurisdiction.
17. Standards of National Electrical Manufacturers. (NEMA)
18. National Fire Protection Association (NFPA) Codes and Standards.
19. OSHA, Occupational Safety and Health Act.
20. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
21. Underwriters Laboratories Inc. (UL)

H. Regulatory Requirements:

1. It is the intention of the Contract Documents that the work described therein is in compliance with codes. Should the Contractor or System Installer discover work shown or noted which is not in code compliance, s/he shall immediately notify the Owner and Engineer. S/He shall not install the work in contravention of any code provision.
2. All packaged equipment shall be independently third party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29 CFR 1910.303 and 1910.399, NFPA 70, and National Electric Code (NEC), Article 90-7.

I. HVAC System Installer Qualifications Installer shall:

1. Be a licensed mechanical Contractor in the State of Maryland and City of Baltimore.
2. Have ten years, minimum, of experience in the installation and maintenance of industrial and heavy commercial HVAC systems.
3. Maintain a full-time, local, staff of engineers, technicians and service/maintenance personnel.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Procurement and Delivery: Coordinate procurement of materials and equipment being

supplied by subcontractors and suppliers to insure timely delivery and installation.

C. Coordination: Coordinate all work with that of other trades to insure proper system operation and a complete building system as desired by Architect/Engineer.

D. Interferences: In case of interferences or scheduling problems during any portion of construction, Architect/Engineer shall decide which work is to be relocated, regardless of which is installed first.

E. Preparation for Finishing: Schedule all prefinish preparation work sufficiently in advance so as not to impede progress of work.

1.07 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed.

D. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

E. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes, and roof expansion joints.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Scheduling: Refer to the Construction Sequence Drawings and related sections for requirements for construction scheduling.

1.09 WARRANTY AND GUARANTEE

A. Warranty and guarantee shall be as specified in Section 01 77 00 with the exception that the warranty period shall be as mentioned below.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components or equipment that fail(s) in materials or workmanship within specified warranty period inclusive of parts, labor, travel and shipping expenses.

1. Warranty Period: Minimum two years from date of Substantial Completion.

1.10 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of

Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1.11 Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by the manufacturers specified.

2.02 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated and mill phosphatized for field painting.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.

C. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated.

2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coated.

3. Exposed Finishes: High-Performance Organic Finish (2-Coat Fluoropolymer): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.

a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements in AAMA 2605, except as modified below:

1) Humidity Resistance: 2000 hours.

2) Salt-Spray Resistance: 2000 hours.

D. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and mill finish. Coil-coat finish as follows:

1. Factory-Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil.

2. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

3. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Conversion coating; Organic Coating: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturer's written instructions.

   a. Color and Gloss: As selected by Architect from manufacturer's full range.

4. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

   a. Color and Gloss: As selected by Architect from manufacturer's full range.

E. Aluminum Extrusions and Tubes: ASTM B 221, alloy and temper recommended by manufacturer for type of use, mill finished.

F. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.

G. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.

H. Steel Tube: ASTM A 500, round tube, baked-enamel finished.

I. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.

J. Galvanized Steel Pipe: ASTM A 53/A 53M.

2.03 MISCELLANEOUS MATERIALS

A. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

B. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

C. Elastomeric Sealant: ASTM C 920, silicone sealant; of type, grade, class, and use

classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.

E. Roofing Cement: ASTM D 4586, non-asbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.04 ROOF CURBS

A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with stepped integral metal cant raised the thickness of roof insulation and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Manufacturers:
   a. Curbs Plus Inc.
   b. Custom Curb, Inc.
   c. Loren Cook Company.
   d. Pate Company (The).
   e. Roof Products & Systems Corporation.
   f. ThyCurb; Div. of Thybar Corporation.
2. Material: Aluminum sheet, 0.090 inch thick.
   a. Finish: Mill.
3. Liner: Same material as curb, of manufacturer's standard thickness and finish.
4. Factory install wood nailers at tops of curbs.
5. Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
   a. Factory insulate curbs with 2 inches thick, cellulosic or glass-fiber board insulation. ASTM C 1071, Type I or II.
   b. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
      1) Liner Adhesive: Comply with ASTM C 916, Type I.
      2) Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.

3) Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.

4) Liner Adhesive: Comply with ASTM C 916, Type I.

6. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 24 inches, unless otherwise indicated.

7. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.05 EQUIPMENT SUPPORTS

A. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with stepped integral metal cant raised the thickness of roof insulation and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Manufacturers:

a. Curbs Plus Inc.

b. Custom Curb, Inc.

c. Loren Cook Company.

d. Pate Company (The).

e. Roof Products & Systems Corporation.

f. ThyCurb; Div. of Thybar Corporation.

2. Material: Aluminum sheet, 0.090 inch thick.

3. Factory-install continuous wood nailers 11-1/2 inches wide and minimum 2 inches thick at tops of equipment supports. Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2.

4. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.

5. Fabricate units to minimum height of 24 inches, unless otherwise indicated.

6. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

7. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.

2.06 PIPE PENETRATION SYSTEMS

A. Graduated Boot Type, Pipe Penetration Systems: Consist of a pre-fabricated roof curb, a laminated acrylic coated ABS thermoplastic reinforced cover with pre-punched mounting holes and molded sealing ring on the collared opening, cadmium-plated fastening screws, EPDM compression molded rubber boots suitable for use with installed pipe sizes and minimum of two stainless steel snap lock swivel action clamps for each boot. Covers shall be resistant to ozone and ultraviolet rays and shall have a serviceable temperature range of -40 degrees F to 250 degrees F. Coordinate dimensions with rough-in information of piping and conduit penetrations.

1. Manufacturers:
   a. Custom Curb, Inc.
   b. Pate Company (The).
   c. Roof Products & Systems Corporation.
   d. ThyCurb; Div. of Thybar Corporation.
2. Roof Curbs: Separate roof curb for each assembly. Comply with the requirements specified in Article “ROOF CURBS” of this section.

B. Hood Type, Pipe Penetration Systems (Dog-House): Removable top cover, faceplate and 3-sided body to provide access to the hood interior.

1. Manufacturers:
   a. Custom Curb, Inc.
   b. Pate Company (The).
   c. Roof Products & Systems Corporation.
   d. ThyCurb; Div. of Thybar Corporation.
2. Material: Aluminum sheet, 0.090 inch thick.
3. Material: Stainless-steel sheet, 0.078 inch thick.
   a. Finish: Mill.
4. Roof Curb: Separate roof curb for each assembly. Comply with the requirements specified in Article “ROOF CURBS” of this section.
5. Field insulate hood interior with 1-1/2-inch- thick, cellulosic glass-fiber board insulation and caulk all exposed joints.

2.07 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 HVAC DEMOLITION

A. Refer to Division 01 Section "Alteration Project Procedures" and Division 02 Section "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

5. Equipment to Be Removed: Disconnect and cap services and remove equipment.

6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 MECHANICAL INSTALLATION – COMMON REQUIREMENTS

A. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment.

B. Coordinate mechanical systems, equipment, and materials installation with other building components.

C. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

D. Verify all dimensions by field measurements.

E. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.

F. 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.

G. 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.

H. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

I. 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.

J. 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.

K. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed.

L. 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.

M. Install access panel or doors where units are concealed.

N. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.03 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:
    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
    f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
2. Existing Piping: Use the following:
    a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
    b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
    c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
    d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
    e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board

partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
    b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
    c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
        1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe

and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

3.04 Verify final equipment locations for roughing-in.

3.05 Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.06 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.07 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

B. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

C. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

D. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

E. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.08 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. Comply with NECA 1.

F. Wiring Method: Install cables in raceways except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceways and Boxes for Electrical Systems."

G. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.09 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

A. Regulatory Requirements: For all electrical equipment, components and wiring, comply with the requirements of NFPA 70, "National Electrical Code" and of the public utility providing power to the project site.

B. Comply with all codes, laws, ordinances, rules and regulations of all federal, state and local governmental authorities having jurisdiction over a project site and of public utilities having connection with any systems shown or specified. Include costs to accomplish compliance.

C. Provide motors for all motor driven equipment included under Division 23 including motors that are factory-installed as part of equipment and appliances as well as field-installed motors. Comply with Division 23 Section “Common Motor Requirements for

HVAC Equipment."

1. The horsepower of motors specified or indicated on the Drawings are those estimated to be required and have been used to determine the electrical feeder and breaker sizes. If the actual horsepower required for any equipment proposed to be furnished differs with that specified or shown on the Drawings, include all costs relative to the electrical changes required under Division 23.

D. Motor Starters: Provide each motor with a motor starter of proper design to meet the requirements of the motor and drive. Provide starters as specified unless modified by other sections of Division 23, by details, control diagrams on the Drawings. Provide all starters of the same manufacturer and comply with Division 26.

1. The Mechanical Contractor shall review the requirements for motor starters against mechanical and electrical drawings; other Division 23 sections; and Division 26 specifications and shall provide those starters required by Division 23 specifications to integrate the mechanical control system. The electrical interface required to utilize low voltage control devices shall be at the sole description of the Division 23 Contractor and the Division 23 Controls Sub-Contractor. Include all materials required for such low voltage installation under Division 23.

E. Under Division 23, furnish a full complement of electrical components required for intended use and/or operation of specified equipment, including line starters, contactors, magnetic controllers, start-stop switches, multi-speed switches and/or other similar devices required, whether integral or remote.

1. Installation of these control devices, power wiring, power wiring through these devices, where required, is under Division 26.

2. Under Division 23, furnish and install control and combination control power wiring and accessories for these devices, for temperature, pressure and other similar control devices, and be responsible for proper functioning of equipment.

3. Provide components and systems in hazardous locations that are suitable for hazard.

F. Conduit and power wiring of required size and voltage from a panel board or motor control center or similar source, shall be furnished and installed under Division 26 to the equipment furnished under Division 23. A junction box or means of disconnect as required by the National Electrical Code shall be furnished and installed at each piece of equipment - either as supplied by the equipment manufacturer or under Division 26. Provide weatherproof components when installed in locations exposed to weather.

G. Electrical work required for system products and installation shall meet or exceed those specified in applicable portions of Division 26 ELECTRICAL. The Division 23 Contractor shall coordinate all electrical work related to mechanical systems' installation with the Division 26 Contractor.

H. Wiring: Run all wiring in rigid galvanized conduit or electrical metallic tubing.

1. Run wiring exposed to view in surface metal raceway in existing construction only.

2. Conceal all wiring in new construction.

3. Refer to Division 26 Sections "Low-Voltage Electrical Power Conductors and Cables" for additional requirements.

I. Refer to Electrical Drawings and Division 26 Specifications for electrical characteristics for this project and, in each case, the service which will be made available for each individual motor. It shall be the responsibility under Division 23 to provide motors of proper current characteristics as required under Division 26.

J. Perform final connections to the terminals (within the terminal housing of the equipment) of motors, electric heaters and other electrical equipment furnished under Division 23. Check for proper rotation of three phase motors and proper functioning of each equipment.

3.10 FIELD QUALITY CONTROL

A. Coordination:

1. The System Installer shall coordinate the dimensions, connections, electrical requirements, controls and arrangements of the equipment, piping, ductwork and other materials, so that these component parts of the system are compatible with each other and so that alignment and other conflicts are eliminated.

2. Accordingly, the System Installer shall review and stamp all shop drawing submittals required by the vendors of the HVAC items prior to submittals to the Engineer. The System Installer's stamp shall warrant that s/he has reviewed such submittals and that the coordination described above has been achieved.

B. Permits: The System Installer shall obtain forms, fill out, pay fees for, and schedule inspections for all permits required for the HVAC work. Any corrective work required as a result of a permit inspection shall be borne by the System Installer at no additional cost to the Owner.

C. Calculations: Following submittals on the HVAC equipment and ductwork, the System Installer shall submit computer generated printouts from new calculations showing duct static pressure losses and noise levels in decibels at various locations along the system. The calculations shall be accompanied with any recommendations for adjustments to fan speeds, type or horsepower or duct sizes or locations so that the design airflows can be met.

3.11 CUTTING AND PATCHING

A. General: Protect installed work and adjacent installations during cutting and patching operations.

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. Provide temporary steel lintels above opening in masonry, concrete, or weight bearing structures.

6. Upon written instructions from the Engineer, uncover and restore work to provide for 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, ducts, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by work under this contract. In no case is work allowed to be abandoned in place, unless otherwise noted on the drawings.

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.

3.12 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.13 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Chamfer edges and corners.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete" or on Drawings.

8. Paint edges of the pads with yellow safety paint.

3.14 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.15 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

D. Refer to Division 06 Section “Miscellaneous Rough Carpentry Wood” for wood and anchorage materials and installation requirements.

3.16 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 09 painting Sections.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.17 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

3.18 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.19 CLOSEOUT PROCEDURES

A. Training: Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment and systems.

B. Equipment/System manufacturer shall provide field training to Owner on the operation and maintenance of the mechanical equipment and system provided. The instructor shall be experienced and approved by the Manufacturer of the equipment/system provided.

1. Refer to other Divisions for minimum training hours requirements. Minimum eight (8) hours for each type of equipment in two four (4) hour sessions.
2. Contractor shall coordinate with Equipment/System Supplier and shall schedule instruction session(s) with the Owner, provide at least 7-day notice to Owner of training date.
3. Schedule training after performing all tests and correction of all deficiencies.
4. Submit to the Owner's Representative sign-in sheets with the dates and names of all training participants. Training sheets must be reviewed and certified by an authorized facility manager.

C. Video Recording: The Contractor shall engage the services of a qualified professional video recorder (referred to as "photographer") approved by the Owner, to make video recordings as indicated. The name and address of the proposed photographer shall be submitted immediately after Notice to Proceed, and before any recording.

1. Video recording shall be of professional quality with optimum contrast and brightness and in sharp focus, and without any background nuisance noise. The Owner shall reserve the right to reject any recording that does not clearly provide the desired objective. Any recording so rejected shall be cause for requiring the photographer to rerecord the intended objective at no additional cost.
2. Narration: Describe scenes on video by audio narration by microphone while or dubbing audio narration off-site after video is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.
    a. Confirm date and time at beginning and end of recording.
    b. Begin each video session with name of Project, Contractor's name, videographer's name, and Project location.
3. Provide video with audio, the training sessions on the operation and maintenance of the mechanical system/equipment to the Owner showing all "HANDS-ON" information, and all start-ups.
4. All video records shall be made on standard DVD-RW discs, with the date and time visible. Use descriptive titles to identify and differentiate training sessions. The DVD case shall contain the following information:
    a. Owner's Name;
    b. Contract title and number;
    c. Contractor's name;
    d. Date recording was done;
    e. Name and address of the Photographer;

f. Names of the Owner's representative witnesses.

5. Provide six copies of the recordings to the Owner. Owner may use these recordings to train personnel or any other objective.

3.20 FIELD QUALITY CONTROL

A. Each contractor, sub-contractor and supplier of equipment shall include in its quoted price the cost of furnishing the material requested and manpower necessary for the operation and maintenance manuals, training and system verification as specified under Division 23.

3.21 MANUFACTURER'S FIELD SERVICES

A. The services of a qualified manufacturer's technical representative shall be provided in accordance with Division 1. For each equipment, field services shall include the following site visits:

Service	**Number of Trips**	**Number of Days/Trip**
Installation and Testing	3	1
Startup and Training	3	1
Services after Startup	3	1

END OF SECTION 23 0500

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SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

C. Provide superior quality motors that provide consistent performance, highest efficiency, improved life cycle and lowest maintenance cost. The motors shall be built to provide the following:

1. Safe operation.
2. Highest efficiency.
3. Reliability in an application, which may be corrosive and wet.
4. Minimum maintenance requirement due to the design and quality of materials and workmanship.
5. Lowest noise pollution.
6. Starting: Each automatically controlled motor shall be capable of starting as frequently as the control sequence may demand. Motors not automatically controlled shall be capable of making no fewer than 4 starts per hour.

D. All motors shall be listed under UL recognized component file.

E. All motors shall be suitable for installation according to the requirements of NEC.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

1. Size motors to be non-overloading under all possible conditions of operation.

2. Motors shall not be smaller than indicated on drawings or in the specifications but may be larger to meet the above requirements.

3. All motors shall be approved by the manufacturer as being appropriate for the services, duties, applications, and operating environments in the manner which they are installed, operated, connected to driven equipment, and otherwise used in mechanical systems. Whenever an equipment supplier purchases motors separately and factory-assembles them into systems, the equipment supplier shall secure the motor manufacturer's approval that said motors are appropriate for all intended uses.

C. Motors 1 HP and Larger: Three phase.

D. Motors Smaller Than 1 HP: Single phase.

E. Frequency Rating: 60 Hz.

F. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

G. Enclosure: Manufacturer's standard Open drip proof (ODP) or Totally Enclosed, Fan Cooled (TEFC) unless otherwise indicated.

H. Totally Enclosed, Air Over (TEAO), where indicated.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1. Comply with the latest ASHRAE 90.1 and International Energy Conservation Code.

C. Service Factor: 1.15 for 1-1/2 HP and larger. 1.25 for 1 HP and smaller.

D. Multispeed Motors: Separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.

2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

5. High-Frequency Bonding: Motors to be bonded from the motor foot to system ground with a high-frequency ground strap made of flat braided, tinned copper with terminations to accommodate motor foot and system ground connection. Provide AEGIS HF Ground Straps, or equal.

6. Shaft Grounding Rings (SGR): Equip motors with a maintenance-free, conductive microfiber shaft grounding ring to meet NEMA MG-1, 3.4.4.4.3 requirements, with a minimum of two rows of circumferential microfibers to discharge damaging shaft voltages away from the bearings to ground.

a. SGR's Service Life: Designed to last for service life of motor. Provide AEGIS SGR Conductive MicroFiber Shaft Grounding Ring or approved equal.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 0513

SECTION 23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 23 0548.13 "Vibration Controls for HVAC" for vibration isolation devices.
3. Section 23 3113 "Metal Ducts" for duct hangers and supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
3. Environmental Product Declaration: For each product.

C. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

D. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. B-line, an Eaton business;.
   b. Flex-Strut Inc.;.
   c. Thomas & Betts Corporation; A Member of the ABB Group;.
   d. Unistrut; Part of Atkore International;.
2. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel (indoor) and stainless-steel, Type 316 (outdoor) channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
8. Metallic Coating: Hot-dip galvanized.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Anvil International;.

   b. Empire Industries, Inc.;.

   c. Gripple Inc.;PHD Manufacturing, Inc;.

2. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.

3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.

4. Channels: Continuous slotted carbon-steel (indoor) and stainless-steel (outdoor) channel with inturned lips.

5. Channel Width: Select for applicable load criteria.

6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

8. Metallic Coating: Pregalvanized G90 or Hot-dip galvanized.

9. Paint Coating: Green epoxy, acrylic, or urethane.

10. Plastic Coating: PVC.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Carpenter & Paterson, Inc;.

2. Clement Support Services;.

3. National Pipe Hanger Corporation;.

4. Pipe Shields Inc.;.

B. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless-steel.

2. Outdoor Applications: Stainless steel.

2.7 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. High-Profile, Single Base, Single-Pipe Stand:

1. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

2. Base: Single vulcanized rubber or molded polypropylene.

3. Vertical Members: Two, galvanized- or stainless-steel, continuous-thread 1/2-inch rods.

4. Horizontal Member: One, adjustable height, galvanized- or stainless-steel pipe support slotted channel or plate.

5. Pipe Supports: Clevis hanger.

6. Hardware: Galvanized- or Stainless-steel.

7. Accessories: Protection pads, 1/2-inch continuous-thread galvanized-steel rod, or 1/2-inch continuous-thread stainless-steel rod.

8. Height: 36 inches above roof.

C. High-Profile, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

2. Bases: Two or more; vulcanized rubber or molded polypropylene.

3. Vertical Members: Two or more, galvanized- or stainless-steel channels.

4. Horizontal Members: One or more, adjustable height, galvanized- or stainless-steel pipe support.

5. Pipe Supports: Strut clamps.

6. Hardware: Galvanized- or Stainless-steel.

7. Accessories: Protection pads, 1/2-inch continuous-thread rod.

8. Height: 36 inches above roof.

D. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.9 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 7200 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

   b. NPS 4: 12 inches long and 0.06 inch thick.

   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 09 9123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 0529

SECTION 23 0548.13 - VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Housed-restrained-spring isolators.
3. Elastomeric hangers.
4. Spring hangers.
5. Vibration isolation equipment bases.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. FEMA: Federal Emergency Management Agency.

D. NRC: Noise Reduction Coefficient.

E. OSHPD: Office of Statewide Health Planning and Development for the State of California.

F. STC: Sound Transmission Coefficient.

G. VISCMA: Vibration Isolation and Seismic Control Manufacturer's Association.

1.4 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: Refer to Structural Drawings.
2. Building Classification Category: Refer to Structural Drawings.
3. Minimum 10 lb/sq. ft. multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation device.

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

2. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads. Include inertia-block mass relative to support equipment weight; spring loads and free, operating, and solid heights of spring; spring diameters; nonmetallic isolator loading and deflection; disturbing frequency; natural frequency of mounts; deflection of working member; and anticipated amount of physical movement at the reference points.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For testing agency.

C. Welding certificates.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-spring mounts and restrained-air-spring mounts to include in operation and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Source Limitations: Obtain sound-absorbing materials from single source from single manufacturer.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
2. Size: Factory or field cut to match requirements of supported equipment.
3. Pad Material: Oil and water resistant with elastomeric properties.
4. Surface Pattern: Ribbed pattern.
5. Infused nonwoven cotton or synthetic fibers.
6. Load-bearing metal plates adhered to pads.
7. Sandwich-Core Material: Resilient and elastomeric.
    a. Surface Pattern: Ribbed pattern.
    b. Infused nonwoven cotton or synthetic fibers.

2.2 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.3 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.4 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.5 VIBRATION ISOLATION EQUIPMENT BASES

A. Steel Rails: Factory-fabricated, welded, structural-steel rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.

a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Rails shall have shape to accommodate supported equipment.

3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

B. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

a. Include supports for suction and discharge elbows for pumps.

b. Height of steel members shall be sufficient to provide stiffness required to maintain equipment manufacturer's recommended alignment and duty efficiency of power-transmission components. Height of steel member shall not result in member deflection at

midpoint of unsupported span of more than 1/1,440th of the span between isolators. Minimum height shall be 5 inches.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Bases shall have shape to accommodate supported equipment with closed-perimeter configuration.

3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 3000 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Rails, structural steel bases, and concrete inertia blocks shall be raised not less than 1 inch above the floor and be level when equipment supported is under operating load.

3.3 APPLICATIONS

A. General: Except as otherwise indicated, select vibration control products in accordance with ASHRAE, 2019 "HVAC Applications" Handbook, Chapter 49 "Noise and Vibration Control. " Where more than one type of product is offered, selection is Professional Engineer's option.

B. Provide vibration isolation hangers for piping and ductwork with a velocity 1500 fpm or higher and for all size ducts in Pressure Classes 2-Inch wg and higher. The isolator deflection shall be equal to or greater than the static deflection of the vibration isolators provided for the connected equipment as follows:

1. High-pressure ductwork: For a distance of 50 feet from fans, exhausters and blowers.

2. Piping connected to vibration isolated equipment: For a distance of 50 feet or 50 pipe diameters, whichever is greater.

C. Seal all piping passing through the equipment walls, floors or ceilings to protect against sound leakage by means of an acoustical seal.

D. Installation of vibration isolators shall not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.

E. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.

6. Measure isolator restraint clearance.

7. Measure isolator deflection.

8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 23 0548.13

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Brimar Industries, Inc.
c. Carlton Industries, LP.
d. Champion America.
e. Craftmark Pipe Markers.
f. emedco.
g. LEM Products Inc.
h. Seton Identification Products.

2. Material and Thickness: Brass, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness and having predrilled or stamped holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Brimar Industries, Inc.
c. Carlton Industries, LP.
d. Champion America.
e. Craftmark Pipe Markers.
f. emedco.
g. LEM Products Inc.
h. Seton Identification Products.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick and having predrilled holes for attachment hardware.
3. Letter Color: Red.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.
7. LEM Products Inc.
8. Seton Identification Products.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick and having predrilled holes for attachment hardware.

C. Letter Color: Red.

D. Background Color: Yellow.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.
7. LEM Products Inc.
8. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.4 DUCT LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark Pipe Markers.
6. emedco.
7. LEM Products Inc.
8. Seton Identification Products.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick and having predrilled holes for attachment hardware.

C. Letter Color: Black.

D. Background Color: Blue.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 15 feet in areas of congested piping and equipment.

B. Pipe Label Color Schedule:
1. Heating Water Piping: White letters on a safety-green background.

2. Refrigerant Piping: Black letters on a safety-orange background.

3.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 25 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 23 0553

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

    a. Constant-volume air systems.

2. Balancing Hydronic Piping Systems.

3. Testing, Adjusting, and Balancing Equipment:

    a. Motors.
    b. Condensing units.
    c. Heat-transfer coils.

4. Testing, adjusting, and balancing existing systems and equipment.
5. Duct leakage tests.
6. Control system verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. Season of maximum heating load: Time of year when outdoor ambient temperature at equipment installation site remains within following range throughout the period of data recording for TAB work.

1. Indicated winter outdoor design dry bulb temperature plus 30 to minus 30 degrees Fahrenheit.

E. Season of maximum cooling load: Time of year when outdoor ambient temperature at equipment installation site remains within following range throughout the period of data recording for TAB work.

1. Indicated summer outdoor design dry bulb temperature plus 15, minus 5 degrees Fahrenheit.

F. TAB: Testing, adjusting, and balancing.

G. TABB: Testing, Adjusting, and Balancing Bureau.

H. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

I. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Needs for coordination and cooperation of trades and subcontractors.
d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 7 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 10 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 10 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 21 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be handwritten, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit four (4) complete sets of draft reports for

review prior to final acceptance of Project. Only 1 complete set of draft reports will be returned.

2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit eight (8) complete sets of final reports. Provide additional copies for inclusion in operation and maintenance manuals. Also, submit two copies in electronic format in Acrobat PDF, Microsoft Word, and Microsoft Excel.
3. Provide reports in binder manuals, complete with index 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.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC or NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB or TABB as a TAB technician.
3. The TAB Firm, in addition to meeting the requirements of certification by the specified balancing entities, shall possess credentials indicating a knowledge and familiarity with the ASHRAE publications listed herein. The TAB Engineer personally or the TAB team members collectively shall attend each of the ASHRAE sponsored seminars listed.
4. Certified in all categories and functions where measurements or performance are specified on the plans and specifications, including TAB of environmental systems building systems commissioning and the measuring of sound and vibration in environmental systems.
5. Maintain the certification for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, the Contractor shall immediately notify the Contracting Officer and submit another TAB Firm for approval. Any firm that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections to be performed by the TAB Firm shall be considered invalid if the TAB Firm loses its certification prior to Contract completion and must be performed by an approved successor.
6. These TAB services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The TAB Firm shall be a subcontractor of the prime

Contractor and shall be financially and corporately independent of the mechanical subcontractor, and shall report to and be paid by the prime Contractor.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS

2.1 SHEAVES AND BELTS

A. The TAB Agent shall be responsible for providing and installing new fan sheaves and belts when required to obtain the designed air flow.

2.2 AIR FILTERS

A. The TAB Agent shall be responsible for providing and installing new, clean air filters. Filters shall be installed before final inspection and before giving notice for the testing, adjusting and balancing.

2.3 BALANCING INSTRUMENTS

A. General: Instruments shall be manufactured by companies regularly engaged in the manufacture of precision instruments of the specific type for a minimum of 10 years. Use of shop-made instruments or use of instruments modified from their original configuration is prohibited. Use of instruments not in manufacture for 10 years is specifically prohibited. Submit data on instruments as specified in submittals paragraph above.

B. Air Flow Measuring Instruments: Instruments used to measure airflow shall be of the Pitot tube type, hot wire anemometer type, turban type, or vortex shedding type.

1. Airflow from air distribution devices shall be measured using an airflow hood with grid type Pitot tube sensing element and inclined liquid manometer for output. The manometer shall be scaled in inches of water column and a conversion chart prepared to convert the readings to air flow in cubic feet per minute at the site elevation and atmospheric conditions.

2. Airflow in ducts shall be measured using precision Pitot tubes and inclined liquid manometers for output. The output from the manometer shall be scaled as specified above. Traverses in the duct shall be as prescribed by ASHRAE or SMACNA.

C. Temperature Measuring Instruments: Instruments used to measure temperature shall be one of the types described below. Use of bimetallic thermometers is prohibited. Mercury or alcohol-filled glass tube thermometers may be used when temperature changes are 0 or less than 1 degree F per hour. Thermometers shall be high quality and have a correction chart furnished with it for temperatures on either side of its true calibration point.

1. Variable resistance devices, RTD's, thermistors, etc., shall be used when temperatures may vary more than 1 degree F per hour. Readings shall be taken using an electronic balanced bridge and meter arrangement. Direct reading instruments are prohibited. Hot wire anemometers may be used in varying temperature situations provided each of the components are a factory-matched assembly.
2. When required or at the contractor's option, thermocouples may be used to measure temperature. An electronic balanced bridge shall be used for output as described above.

2.4 PRESSURE MEASURING INSTRUMENTS

A. Instruments used to measure pressure shall be the liquid manometer type, bourdon tube type, precision transducer type, strain gauge type, or dead weight, piston and cylinder type.

B. Manometers using water or alcohol shall be used to measure low pressures or differential pressures in the zero to 60 inches of water range.

C. Manometers utilizing mercury shall be used to measure pressures in the zero to 60 inches of mercury range.

D. Bourdon tube type pressure gauges, precision transducers, strain gauges, and deadweight type instruments shall be used for pressures 10 psi and above or –5 psi and below. Compound gauges shall not be used to measure pressures below atmospheric.

E. Atmospheric pressure shall be measured by using a mercury barometer.

2.5 HUMIDITY MEASURING INSTRUMENTS

A. Instruments used to measure humidity shall be of the precision electronic type or the use of a sling psychrometer may be used.

2.6 ROTARY SPEED MEASURING INSTRUMENTS

A. Rotary speeds, generally in RPM, shall be measured using a precision, magnetic direct reading tachometer, strobic effect type electronic tachometer or a revolution counter with stopwatch.

B. When rotary speed is expected to vary as in variable speed equipment, strobic effect devices or electronic tachometers shall be used.

2.7 ELECTRICAL MEASURING INSTRUMENTS

A. Electrical measurements shall be taken with precision, solid state, electronic devices. Voltage, amperage, wattage and power factor readings shall utilize digital output type reading and recording instruments.

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:

1. To Be Pre-Approved.

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment and identify discrepancies.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine operating safety interlocks and controls on HVAC equipment.

M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

2. Hydronics:

a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
b. Piping is complete with terminals installed.
c. Systems are flushed, filled, and air purged.
d. Strainers are pulled and cleaned.
e. Control valves are functioning per the sequence of operation.
f. Shutoff and balance valves have been verified to be 100 percent open.

g. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance",or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", ASHRAE 111 and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path. Dampers further from the air distribution device shall be set first. Dampers within the device shall be used for final airflow settings to minimize noise generation.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Construction Manager and Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Test and adjust outside air on applicable equipment using a pitot-tube traverse. If a traverse is not practical use the mixed-air temperature method if the inside and outside temperature difference is at least 20 degrees F or use the difference between Pitot-tube traverses of the supply and return air ducts.

C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

D. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

E. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:

1. Check liquid level in expansion tank.
2. Check highest vent for adequate pressure.
3. Check flow-control valves for proper position.
4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
5. Verify that motor starters are equipped with properly sized thermal protection.
6. Check that air has been purged from the system.

3.8 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.9 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.10 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Inlet steam pressure.

C. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

3.11 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.12 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.

4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.13 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
1. Measure motor voltage and amperage. Compare the values to motor nameplate information.
2. Check the condition of filters.
3. Check the condition of coils.
4. Check the operation of the drain pan and condensate-drain trap.
5. Check bearings and other lubricated parts for proper lubrication.
6. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

D. Balance each hydronic PTAC, fan coil units, and Radiator on the heating water system distribution affected by the project work..

3.14 TOLERANCES

A. Set HVAC system's airflow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: 0 or Plus 5 percent.
2. Air Outlets and Inlets: 0 or Plus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

C. Equipment capacities shall be adjusted in accordance with the following:

1. Fan capacities shall be adjusted by changing fan speeds provided the adjustment does not result in increasing the energy consumption beyond 10 percent. Obtain approval from the Design A/E prior to making permanent changes. Verify that changing speeds will not result in unstable or noisy operation of the system.

D. Pump capacities shall be adjusted by position balancing valves on the discharge side of the pump. If valve positioning results in 10% or more of an increase in pump head, verify from the pump curve data that the efficiency of the pump has not decreased by more than 5 percent. Evaluate and recommend in the report whether another impeller size would result in satisfactory operation and increased efficiency.

3.15 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

C. Prepare report of recommendations for correcting unsatisfactory performance when system cannot be successfully balanced. Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

3.16 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.

4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Settings for supply-air, static-pressure controller.
    g. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. System Control Performance Report: Include the operation of each of the control devices including valves, dampers, motors, flow metering devices and actuators during the occupied period. The report shall be in two parts, interim and final report. The report shall identify ASHRAE Standards 90.1 and 62 compliance and deviations shall be documented. Report shall include performance of:

1. Control valves.
2. Control dampers.
3. Flow meters.
4. Sensors.
5. Central console.
6. Controller.

F. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Filter static-pressure differential in inches wg.
    f. Preheat-coil static-pressure differential in inches wg.
    g. Cooling-coil static-pressure differential in inches wg.
    h. Heating-coil static-pressure differential in inches wg.
    i. Outdoor airflow in cfm.

j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. VFD settings.

G. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig.
j. Refrigerant suction temperature in deg F.
k. Inlet steam pressure in psig.

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

    a. Heat output in Btu/h.
    b. Airflow rate in cfm.
    c. Air velocity in fpm.
    d. Entering-air temperature in deg F.
    e. Leaving-air temperature in deg F.
    f. Voltage at each connection.
    g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.
    f. Arrangement and class.
    g. Sheave make, size in inches, and bore.
    h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Suction static pressure in inches wg.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

    a. System and air-handling-unit number.
    b. Location and zone.
    c. Traverse air temperature in deg F.

d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

L. System-Coil Reports: For water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.

e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

M. DDC System/Controls Verification Report: Indicating date performed, systematic listing of the indicated testing and verification, and any abnormalities identified.

1. Point Location/Description.
2. BMS/BAS Readout (Set point and Actual).
3. Actual Readout.
4. Interlocks.
5. Safeties.
6. Alarms.
7. Sequences of Operation.

N. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.17 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager or Commissioning Authority.

B. Construction Manager or Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.

3. If the second verification also fails, Owner or design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.18 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

3.19 TRAINING

A. TAB shall meet for six hours with facility staff after completion of TAB and instruct them on the following:

1. Review the final TAB report, explaining the layout and meanings of each data type.
2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.

B. Other salient information that may be useful for facility operations, relative to TAB.

END OF SECTION 23 0593

SECTION 23 0713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed, and exposed supply, outdoor, and return air.
2. Indoor, concealed return and exhaust air located in unconditioned space.

B. Related Sections:

1. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

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

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For coatings, indicating VOC content.
4. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
5. Product Data: For sealants, indicating VOC content.
6. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type II with factory-applied vinyl jacket or Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed Corporation.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Knauf Insulation.
    d. Owens Corning.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed Corporation.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Knauf Insulation.
    d. Owens Corning.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
   c. Mon-Eco Industries, Inc.
2. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
   c. Mon-Eco Industries, Inc.
2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. VOC Content: 300 g/L or less.
2. Low-Emitting Materials: Mastic coatings 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." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Knauf Insulation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Knauf Insulation.
d. Mon-Eco Industries, Inc.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Mon-Eco Industries, Inc.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

B. ASJ Flashing Sealants, and Vinyl 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.
5. Sealant shall have a VOC content of 420 g/L or less.
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.

b. Compac Corporation.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.
e. Venture Tape.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.
e. Venture Tape.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ITW Insulation Systems; Illinois Tool Works, Inc.
b. RPR Products, Inc.

B. Insulation Pins and Hangers:
1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) AGM Industries, Inc.
2) Gemco.
3) Hardcast, Inc.
4) Midwest Fasteners, Inc.
5) Nelson Stud Welding.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

c. Spindle: Copper- or zinc-coated, low-carbon steel or Aluminum or Stainless 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.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel or aluminum or stainless-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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) AGM Industries, Inc.
2) Gemco.
3) Hardcast, Inc.
4) Midwest Fasteners, Inc.
5) Nelson Stud Welding.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. C & F Wire.

2.9 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. 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.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 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 one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers 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 one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.6 FINISHES

A. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply, exhaust, return, and outdoor air.
2. Indoor, exposed supply, exhaust, and outdoor air.
3. Indoor, concealed return located in unconditioned space.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Outdoor-Air, Supply-Air Duct and Plenum Insulation (Duct widths less than 12-inches): Mineral-fiber blanket, 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.

B. Concealed, Outdoor-Air, Supply-Air Duct and Plenum Insulation (Duct widths 12-inches or larger): Mineral-fiber board, 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

C. Concealed, Exhaust-Air, Return-Air Duct and Plenum Insulation (Duct widths less than 12-inches): Mineral-fiber blanket, 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.

D. Concealed, Exhaust-Air, Return-Air Duct and Plenum Insulation (Duct widths 12-inches or larger): Mineral-fiber board, 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

E. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

F. Exposed, Exhaust-Air, Return-Air Duct and Plenum Insulation: Mineral-fiber board, 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

G. Exposed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber board, 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

3.10 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Omitted.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.

END OF SECTION 23 0713

SECTION 23 0719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping, indoors.
2. Heating hot-water piping, indoors, existing.
3. Refrigerant suction, liquid, and hot-gas piping, indoors and outdoors.

B. Related Sections:

1. Section 23 0713 "Duct Insulation."

1.2 ACTION SUBMITTALS

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

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For coatings, indicating VOC content.
4. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
5. Product Data: For sealants, indicating VOC content.
6. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Aboveground Piping Insulation Schedule," articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA, Inc. “Armaflex Lapseal”
b. Armacell LLC.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. Knauf Insulation.

c. Owens Corning.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type II, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA, Inc.
b. Armacell LLC.
c. Foster Brand; H. B. Fuller Construction Products.

2. Adhesives shall have a VOC content of 50 g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Mon-Eco Industries, Inc.

2. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Mon-Eco Industries, Inc.

2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dow Corning Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Speedline Corporation.

2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.3 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

1. VOC Content: 300 g/L or less.
2. Low-Emitting Materials: Mastic coatings 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." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Knauf Insulation.

2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.
5. Color: White.

2.4 SEALANTS

A. Joint Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. Sealant shall have a VOC content of 420 g/L or less.
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

B. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Mon-Eco Industries, Inc.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Childers Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. Sealant shall have a VOC content of 420 g/L or less.

7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
3. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.

4. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. Proto Corporation.
c. Speedline Corporation.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. ITW Insulation Systems; Illinois Tool Works, Inc.
c. RPR Products, Inc.

2. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
3. Finish and thickness are indicated in field-applied jacket schedules.
4. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
5. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
6. Factory-Fabricated Fitting Covers:

a. Same material, finish, and thickness as jacket.
b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
c. Tee covers.
d. Flange and union covers.
e. End caps.
f. Beveled collars.
g. Valve covers.
h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. 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 white stucco-embossed aluminum-foil facing.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Ideal Tape Co., Inc., an American Biltrite Company.
c. Knauf Insulation.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division.
    b. Ideal Tape Co., Inc., an American Biltrite Company.
    c. Knauf Insulation.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Ideal Tape Co., Inc., an American Biltrite Company.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ITW Insulation Systems; Illinois Tool Works, Inc.
    b. RPR Products, Inc.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy or 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. C & F Wire.

PART 3 - EXECUTION

3.1 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.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

    1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.3 PENETRATIONS

A. 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.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe

insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric 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. 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.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

A. Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Heating-Hot-Water Supply and Return, 200 Deg F and Below: Insulation shall be the following:

1. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick.

C. Refrigerant Suction, Liquid and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.

D. Refrigerant Suction, Liquid and Hot-Gas Flexible Tubing: Flexible elastomeric, 1 inch thick.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction, Liquid and Hot-Gas Piping: Insulation shall be one of the following:

1. Flexible Elastomeric: 2 inches thick.

B. Refrigerant Suction, Liquid and Hot-Gas Flexible Tubing: Insulation shall be the following:

1. Flexible Elastomeric: 2 inches thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. PVC Fittings Covers: 20 mils thick.

D. Piping, Exposed:

1. Aluminum, Stucco Embossed: 0.040 inch thick.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. Aluminum, Stucco Embossed: 0.040 inch thick.

D. Piping, Exposed:

1. Aluminum, Stucco Embossed: 0.040 inch thick.

END OF SECTION 23 0719

SECTION 23 0993.11 - SEQUENCE OF OPERATIONS FOR HVAC DDC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes control sequences for HVAC systems, subsystems, and equipment.

1.3 DEFINITIONS

A. Analog Output: Proportional output signal (zero- to 10-V dc, 4 to 20 mA).

B. Binary Output: On/off output signal or contact closure.

C. DDC: Direct digital control.

D. Digital Output: Data output that must be interpreted digitally.

1.4 ACTION SUBMITTALS

A. Product Data:

1. An instrumentation list for each controlled system. Label each element of the controlled system in table format. Show, in the table element name, type of device, manufacturer, model number, and control device product data sheet number.

2. A complete description of the operation of the control system, including sequences of operation. Include and reference a schematic diagram of the controlled system.

B. Shop Drawings:

1. Riser diagrams showing control network layout, communication protocol, and wire types.

2. Schematic diagram of each controlled system. Include all control points labeled with point names shown or listed. Show the location of control elements in the system.

3. Wiring diagram for each controlled system. Show all control elements labels. Where a control element is the same as that shown on the control system schematic, label with the same name. Label all terminals.

1.5 VARIABLE REFRIGERANT FLOW SPLIT SYSTEM AIR CONDITIONERS

A. Provide DDC hardware to perform this Sequence of Operation, Scheduling, and to provide inputs and outputs and interface as specified and shown on the Points Schedule. Install and wire system control components furnished by the system manufacturer. Comply with additional requirements in Section 23 8129 "Variable-Refrigerant-Flow HVAC Systems." The system manufacturer furnished BACnet interface used in conjunction with system manufacturer furnished centralized controller shall provide control points for monitor and operation via BACnet.

B. Each Indoor SSU shall be scheduled ON by the Central Controller (CC) or BAS Workstation at the occupied times defined by the Owner. All VRF systems and Ductless Split Systems shall be interfaced and controlled through the CC and BAS for remote monitoring and controls.

C. DOAS-01 Sequence of Operation

1. Each DOAS unit shall operate based on building occupancy schedule or whenever the associated indoor VRF unit(s) are in occupied mode. The DOAS unit shall operate in constant volume auto (heat/cool) mode. When in occupied mode, the unit shall maintain the supply air temperature setpoint, adjustable (temperature setpoint range is between 50 deg F and 65 deg F).

2. Outdoor intake air damper will open and close based on associated indoor DOAS unit's fan status and schedule. When fan status is proven on, the isolation damper relay (CN27) shall be energized, opening the damper. When fan status is off, the isolation damper relay (CN27) shall be de-energized, closing the damper. Isolation damper shall fail open.

3. Electric duct heating coil shall be interlocked with the respective DOAS unit and operated as per the control sequence specified in Section 23 8216.14 "Electric-Resistance Air Coils."

4. The user shall be able to manually start/stop the DOAS by overriding the schedule from the Centralized Controllers, Web Browser or Initial Settings Tool. The next scheduled event from the Centralized Controller's schedule shall not be interrupted or altered. The outside air temperature, outside air humidity, supply air temperature, supply air humidity, return air temperature and return air humidity shall be monitored, displayed and trended for high/low/abnormal values through CC, Web Browser, and Initial Settings Tool. If supply air humidity and/or supply air temperature exceeds the preset high and low limits (user defined) then an alarm shall be generated.

D. Occupancy Modes:

1. Occupied: The DDC Hardware shall be in the Occupied Mode when the local space occupancy input(s) indicate that the space is occupied or when the input from the System Scheduler is occupied.

2. Unoccupied: The DDC Hardware shall be in the Unoccupied Mode when the local space occupancy input(s) indicate that the space is unoccupied and when the input from the System Scheduler is unoccupied.

E. For Outdoor unit coupled with a BC Controller, the indoor units shall be set to AUTO mode during occupied times. During unoccupied times the indoor units shall be set to HEAT or COOL based on outside air enthalpy conditions.

F. The CC shall set the occupied and unoccupied temperature set-points based on the owner's request. Temperature set-points may be changed at the RC (remote controller), Central Controller, or through DDC interface.

G. Heat/Cool Changeover Modes: The Central Controller or DDC Hardware shall determine and set the Heating/Cooling MODE of ALL the indoor units and the resultant control action, based on outside air enthalpy conditions and averaging the zone heating/cooling demand. The heat pump type outdoor unit shall change between heating and cooling mode if all of the indoor units change to the same mode. The Central Controller or DDC Hardware shall poll the system for overall heating/cooling demand. Average demand shall be calculated based on the indoor units' capacities and individual temperature set point deviation. A HEAT or COOL mode shall be set based on the calculation and all zones connected to the system shall control space temperature in that mode or go into a "Standby Mode." The DDC Hardware shall send PROHIBIT commands for prohibiting the MODE button at the local remote controller in the space during occupied and unoccupied times.

1. Option 2, Representative Zone: The user can select a representative zone through the Central Controller touch screen interface. When the mode for the representative zone is changed, all the other zones shall be set to the same mode. The representative zone shall be a single unit zone.

2. Option 3, Scheduling: Indoor units shall be scheduled to the same mode using the Central Controller scheduling feature.

H. The CC shall send PROHIBIT commands for prohibiting the MODE button at the local remote controller in the space during occupied and unoccupied times.

I. The CC shall send PROHIBIT commands for prohibiting the ON/OFF button at the local remote controller in the space during occupied times only. The CC shall send PERMIT commands for permitting the ON/OFF button at the local remote controller in the space during unoccupied times to allow for setback override.

J. During unoccupied times the CC shall send the OFF command to the indoor unit at the start of unoccupied times and every two hours thereafter to reinforce the setback conditions. The CC shall monitor the Room Temperature at the remote controller in the space and command the unit ON if the owner specified night setback limits are

exceeded. The CC shall send the COOL mode command when the upper limit is exceeded or the HEAT mode command when the lower limit is exceeded. The CC shall send the upper or lower limit as the space temperature set-point during unoccupied time.

K. Safeties: The system shall run subject to the system manufacturer's safeties.

L. Alarms:

1. Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adjustable).

2. High Zone Temp: If the zone temperature is higher than the cooling setpoint by a user definable amount (adjustable).

M. Display:

1. CC system graphic.

2. CC system on-off indication.

3. CC system occupied/unoccupied mode.

4. Indoor Units:
   a. All OFF (Emergency Stop) Command.
   b. ON/OFF Command.
   c. Operation Mode Command.
   d. Set Temperature.
   e. Prohibit ON/OFF at Remote Controller.
   f. Prohibit Mode at Remote Controller.
   g. Prohibit Limit Temperature Setting Range.
   h. ON/OFF Status.
   i. Operation Mode State.
   j. Room Temperature.
   k. Fan Speed Command.
   l. Fan Speed State.
   m. Air Direction Command.
   n. Air Direction State.
   o. Alarm Signal (Unit).
   p. Error Code (system).
   q. Filter Sign.
   r. Filter Sign reset.
   s. Prohibit Filter Sign Reset.
   t. Prohibit Set Temperature.
   u. Network Communication State.
   v. System Forced Off.

5. Outdoor Units:
   a. ON/OFF Command.

b. Operation Mode Command.
c. ON/OFF Status.

6. DOAS Units:
   a. DOAS Start/Stop
   b. DOAS Status
   c. DOAS Alarm
   d. Supply Air Temperature
   e. Supply Air Humidity
   f. Return Air Temperature
   g. Return Air Humidity
   h. Outside Air Temperature
   i. Outside Air Humidity
   j. Ventilation Mode Command.
   k. Ventilation Mode State.
   l. Ventilation Damper Command.
   m. Ventilation Damper Status.
   n. Expansion Controller Communication State

1.6 VENTILATION SEQUENCES

A. Gravity Intake Penthouse:

1. Input:
   a. Device: Interlock motor operated damper with respective VRF DOAS-01.

2. Output:
   a. Device: Hard wired to DOAS.
   b. Location: Control damper.
   c. Transference: Damper actuator.

3. Action: Open control damper when space is occupied and before DOAS is energized. Close control damper when space is unoccupied and after DOAS is deenergized.

B. Exhaust fan serving Toilets, Janitor Closets, Showers, Locker Rooms, and Storage Rooms [EF-01, EF-02, EF-03]

1. When ON-AUTO-OFF switch at the starter is manually indexed to normal AUTO position, the exhaust damper shall open and the exhaust fan shall be automatically started and run intermittently for 15 minute per hour (adjustable) when the motor operated damper is fully open at the beginning of the occupied cycle and/or any of the room occupancy is sensed by the occupancy sensor(s) and automatically stopped at the end of the occupied cycle and motor operated damper is fully closed.

2. When the ON-AUTO-OFF switch is manually indexed to ON position, the exhaust damper shall open, and the fan shall be automatically started when the motor operated damper is fully open. The fan shall be automatically stopped, and

the motor operated damper shall be fully closed when the switch is manually indexed to OFF position.

3. When the ON-AUTO-OFF switch is manually indexed to OFF position, the fan shall remain de-energize and the motor operated damper shall remain fully closed.

4. Provide a motor operated control damper and related control and interface wiring for each fan. Each fan shall have a user definable (adjustable) minimum runtime. Respective DOAS-01 shall be interlocked to operate whenever the respective exhaust fan is energized to provide the make-up air.

5. Display:
   a. DDC system graphic.
   b. DDC system on-off indication.
   c. DDC system occupied/unoccupied mode.
   d. Room/area served.
   e. Room occupied/unoccupied.
   f. Exhaust-fan on-off indication.
   g. Fan damper position.

6. Alarms: Alarms shall be provided as follows:
   a. Damper Failure: Commanded open, but the status is closed.
   b. Damper in Hand: Commanded closed, but the status is open.
   c. Fan Failure: Commanded on, but the status is off.
   d. Fan in Hand: Commanded off, but the status is on.
   e. Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adjustable).

1.7 MISCELLANEOUS SEQUENCES

A. Emergency HVAC Systems Shutdown:

1. In accordance to NFPA 90A Section 6.2, provide covered mushroom type momentary pushbutton type emergency switch (E-STOP-SW) or similar device to shut down all HVAC systems serving each building. Emergency switch in secured cover shall be located at the building administration office, and at locations easily accessible by building occupants and with at least one shut-off switch per floor so that the travel distance to the nearest shutoff switch shall not be in excess of 200 feet. Final location(s) of the switch(es) shall be as directed by Owner. Owner will have only authorized personnel to activate this function. In the Priority Shutdown mode, all HVAC system components shall be disabled, including the supply fan, exhaust fan, heating, and cooling functions. The switch(s) shall have one Normally Closed (NC) contact wired into the AHU fan(s) safety circuit and one Normally Open (NO) contact wired to the BAS system for monitoring and alarming at the central console. Emergency shutoff switches shall be labeled “Emergency HVAC Shutdown Switch-Building ##” and differentiated from the building fire alarm pull stations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 0993.11

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SECTION 23 2300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Refrigerant pipes and fittings.
2. Refrigerant piping valves and specialties.
3. Refrigerants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and piping specialty.

1. Include pressure drop, based on manufacturer's test data, for the following:

a. Thermostatic expansion valves.
b. Solenoid valves.
c. Hot-gas bypass valves.
d. Filter dryers.
e. Strainers.
f. Pressure-regulating valves.

B. Shop Drawings:

1. Show equipment/system manufacturer approved layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes; flow capacities; valve arrangements and locations; slopes of horizontal runs; oil traps; double risers; wall and floor penetrations; and equipment connection details.
2. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
3. Show interface and spatial relationships between piping and equipment.
4. Shop Drawing Scale: 1/4-inch equals 1 foot.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type K ACR. UL Recognized to 700 PSI at 250 deg. F.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8/A5.8M.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Danfoss Inc.

   b. Heldon Products; Henry Technologies.

   c. Parker Hannifin Corp.

   d. Paul Mueller Company.

2. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
3. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
4. Operator: Rising stem and hand wheel.
5. Seat: Nylon.
6. End Connections: Socket, union, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Danfoss Inc.

   b. Heldon Products; Henry Technologies.

   c. Parker Hannifin Corp.

   d. Paul Mueller Company.

2. Body and Bonnet: Forged brass or cast bronze.
3. Packing: Molded stem, back seating, and replaceable under pressure.
4. Operator: Rising stem.
5. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
6. Seal Cap: Forged-brass or valox hex cap.
7. End Connections: Socket, union, threaded, or flanged.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Danfoss Inc.

    b. Emerson Climate Technologies.

    c. Heldon Products; Henry Technologies.

    d. Parker Hannifin Corp.

    e. Paul Mueller Company.

2. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
3. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
4. Piston: Removable polytetrafluoroethylene seat.
5. Closing Spring: Stainless steel.
6. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
7. End Connections: Socket, union, threaded, or flanged.
8. Maximum Opening Pressure: 0.50 psig.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Danfoss Inc.

    b. Emerson Climate Technologies.

    c. Heldon Products; Henry Technologies.

    d. Parker Hannifin Corp.

    e. Paul Mueller Company.

2. Body: Forged brass with brass cap including key end to remove core.
3. Core: Removable ball-type check valve with stainless-steel spring.
4. Seat: Polytetrafluoroethylene.
5. End Connections: Copper spring.
6. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Danfoss Inc.

b. Emerson Climate Technologies.

c. Heldon Products; Henry Technologies.

d. Parker Hannifin Corp.

e. Paul Mueller Company.

2. Body and Bonnet: Plated steel.
3. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
4. Seat: Polytetrafluoroethylene.
5. End Connections: Threaded.
6. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24 or 115 or 208-V ac coil.
7. Working Pressure Rating: 400 psig.
8. Maximum Operating Temperature: 240 deg F.

F. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Danfoss Inc.

b. Heldon Products; Henry Technologies.

c. Parker Hannifin Corp.

d. Paul Mueller Company.

2. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
3. Piston, Closing Spring, and Seat Insert: Stainless steel.
4. Seat: Polytetrafluoroethylene.
5. End Connections: Threaded.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

G. Thermostatic Expansion Valves: Comply with AHRI 750.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Danfoss Inc.

b. Emerson Climate Technologies.

c. Heldon Products; Henry Technologies.

d. Paul Mueller Company.

2. Body, Bonnet, and Seal Cap: Forged brass or steel.
3. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
4. Packing and Gaskets: Non-asbestos.
5. Capillary and Bulb: Copper tubing filled with refrigerant charge.
6. Suction Temperature: 40 deg F.
7. Superheat: Adjustable.
8. Reverse-flow option (for heat-pump applications).
9. End Connections: Socket, flare, or threaded union.
10. Working Pressure Rating: 450 psig.

H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Danfoss Inc.

b. Heldon Products; Henry Technologies.

c. Parker Hannifin Corp.

2. Body, Bonnet, and Seal Cap: Ductile iron or steel.
3. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
4. Packing and Gaskets: Non-asbestos.
5. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
6. Seat: Polytetrafluoroethylene.
7. Equalizer: Internal.
8. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter and 24 or 115 or 208-V ac coil.
9. End Connections: Socket.
10. Set Pressure: To suit field conditions.
11. Throttling Range: Maximum 5 psig.
12. Working Pressure Rating: 500 psig.
13. Maximum Operating Temperature: 240 deg F.

I. Angle-Type Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Danfoss Inc.

b. Heldon Products; Henry Technologies.

c. Parker Hannifin Corp.

2. Body: Forged brass or cast bronze.
3. Drain Plug: Brass hex plug.
4. Screen: 100-mesh monel.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

J. Moisture/Liquid Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Danfoss Inc.

   b. Emerson Climate Technologies.

   c. Heldon Products; Henry Technologies.

   d. Parker Hannifin Corp.

2. Body: Forged brass.
3. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
4. Indicator: Color coded to show moisture content in parts per million (ppm).
5. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
6. End Connections: Socket or flare.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 240 deg F.

K. Replaceable-Core Filter Dryers: Comply with AHRI 730.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Danfoss Inc.

   b. Emerson Climate Technologies.

   c. Heldon Products; Henry Technologies.

   d. Parker Hannifin Corp.

2. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
3. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
4. Desiccant Media: Activated alumina or charcoal.
5. Designed for reverse flow (for heat-pump applications).
6. End Connections: Socket.

7. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
8. Maximum Pressure Loss: 2 psig.
9. Rated Flow: 1.15 times installed capacity.
10. Working Pressure Rating: 500 psig.
11. Maximum Operating Temperature: 240 deg F.

L. Mufflers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Danfoss Inc.

   b. Emerson Climate Technologies.

   c. Heldon Products; Henry Technologies.

2. Body: Welded steel with corrosion-resistant coating.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

M. Receivers: Comply with AHRI 495.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Heldon Products; Henry Technologies.

2. Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
3. Comply with UL 207; listed and labeled by an NRTL.
4. Body: Welded steel with corrosion-resistant coating.
5. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
6. End Connections: Socket or threaded.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

N. Liquid Accumulators: Comply with AHRI 495.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Emerson Climate Technologies.

   b. Heldon Products; Henry Technologies.

   c. Parker Hannifin Corp.

2. Body: Welded steel with corrosion-resistant coating.
3. End Connections: Socket or threaded.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

2.4 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Arkema Inc.

b. DuPont Fluorochemicals Div.

c. Genetron Refrigerants; Honeywell International Inc.

d. Mexichem Fluor Inc.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

B. Suction Lines NPS 2 to NPS 3-1/2 for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

C. Hot-Gas and Liquid Lines: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

D. Safety-Relief-Valve Discharge Piping:

1. NPS 5/8 and Smaller: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
2. NPS 3/4 to NPS 1 and Smaller: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
3. NPS 1-1/4 and Smaller: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
4. NPS 1-1/2 to NPS 2: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install packed-angle valves on inlet and outlet side of filter dryers.

E. Install a full-size, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections. Use only long-radius elbows. Short-radius elbows or use of two 45-degree elbows will not be acceptable.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Identify refrigerant piping and valves according to Section 23 0553 "Identification for HVAC Piping and Equipment."

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 0517 "Sleeves and Sleeve Seals for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Comply with requirements for pipe hangers and supports specified in Section 23 0529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:

1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 2300

SECTION 23 3113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Sealant and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 DEFINITIONS

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.
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.

B. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C168. In this section, these values are the result of the formula Btu x in./h x sq. ft. x deg F (W/m x K) at the temperature difference specified. Values are expressed as Btu or W.

1. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.

C. Density: Expressed in lbs/sq.ft (PCF).

D. Transverse Joints: Connections of two duct or fitting elements oriented perpendicular to air flow and include, but are not limited to, spin-ins, taps, and other branch connections, access doors frames, and duct connection to equipment.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

B. Right is reserved by Architect for the final locations and equivalent size of the ductwork until final fabrication and installation.

1.5 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article whichever is most stringent.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives. For adhesives and sealants, including printed statement of VOC content.
2. Sealants and gaskets. For adhesives and sealants, including printed statement of VOC content.
3. Sheet metal materials, including printed statement of thicknesses in inches.
4. Hangers and supports.
5. Fire stopping materials.
6. Prefabricated metal ductwork.

B. Shop Drawings: CAD-generated and drawn to 1/4-inch equals 1-foot scale.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports.

1.7 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, sections, drawn to minimum 1/4-inch equals 1-foot (1:50) scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Other systems installed in same space as ducts.
5. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
6. Size and location of initial access modules for acoustical tile.
7. Penetrations of smoke barriers and fire-rated construction.
8. Detailed view of duct shape, reinforcement, and hanger support for exposed ducts.
9. Entire project work area of the facility including existing ductwork to remain.
10. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.

c. Speakers.
d. Sprinklers.
e. Access panels.
f. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

1. Indicate leakage tests performed. Include date; section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.
2. Documentation of work performed for compliance with ASHRAE/IESNA 90.1-2010, Section 6.4.4.2.2 - "Duct Leakage Tests" and 2012 International Energy Conservation Code.

D. Record Drawings: Indicate actual routing, elevations, fittings details, reinforcement, support, and installed accessories and devices. Comply with the requirements of Division 1 Sections.

1.8 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

D. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

E. Sheet Metal & Air Conditioning Contractors' National Association, Inc. (SMACNA) Compliance:

1. SMACNA HVACADLTM "HVAC Air Duct Leakage Test Manual."
2. SMACNA HVAC DCS, "HVAC Duct Construction Standard - Metal and Flexible, Third Edition, 2005."

F. Mockups:

1. Before installing duct systems, build mockups representing static-pressure classes in excess of 3-inch wg. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

a. Five transverse joints.
b. One access door(s).
c. Two typical branch connections, each with at least one elbow.
d. Two typical flexible-connector connections for each duct and apparatus.
e. One 90-degree turn(s) with turning vanes.
f. One fire damper(s).
g. One discharge plenum at air handling unit.
h. Three joints and supports on exterior exposed ducts.
i. Three typical security supply grille assembly at inmate cells.
j. Three typical return air perforated door sweep assembly at existing cell doors.
k. Perform leakage tests specified in "Field Quality Control" Article. Revise mockup construction and perform additional tests as required to achieve specified minimum acceptable results.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Fabricator and Installer's Qualifications: Company specializing in performing the work of this section with minimum ten years documented experience.

H. Single Source Responsibility: Provide all prefabricated round, flat oval, rectangular duct, and fittings manufactured by the same manufacturer. Prefabricated ductwork shall refer to ductwork constructed and assembled by one of the listed manufacturers below who specialize in this trade. Contractor or shop-fabricated ductwork as specified by this section is not acceptable.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Unless otherwise indicated, select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Transverse Duct Connection System: SMACNA "F", "J" or "K" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, metal cleats, and corner clips.
2. Use transverse joints with T24 or T 25a/T 25b reinforcement or gasketed slip on flange In accordance with SMACNA HVAC DCS, Figure 2-1 and applicable Tables

C. Longitudinal Seams: Unless otherwise indicated, select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Use Pittsburgh Lock on all longitudinal seams and seal with mastic sealant. Type L-2 (Snap Lock), Type L-4(Standing Seam), Type L-5 (Single Corner Seam) are not acceptable.

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359-inch-thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined or duct pressure class is over 3-inch wg Beading and cross breaking is not substitutes for reinforcement.

2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ductmate Industries, Inc.
    b. Hamlin Sheet Metal, Inc.
    c. Lindab Inc.
    d. McGill AirFlow LLC.
    e. SEMCO LLC.
    f. Sheet Metal Connectors, Inc.
    g. Spiral Manufacturing Co., Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

D. Transverse Joints: Unless otherwise indicated, select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

E. Round Longitudinal Seams and Spiral Lock Seams: Unless otherwise indicated, select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Use Seams Types RL-1, RL-4 or RL-5. Seams types RL-2 or RL-3 may be used if spot-welded on 1-inch intervals or tack welded on 3-inch intervals.
2. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
3. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
4. Use only spiral lock seams (without intermediate ribs) for exposed ducts.

F. Flat-Oval, Longitudinal- and Spiral Lock-Seam Ducts: Unless otherwise indicated, select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-7, "Flat Oval Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
2. Use only spiral lockseams (without intermediate ribs) for exposed ducts.

G. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

H. Lined Ducts: Fabricate lined insulated ducts with an outer shell, liner insulation, as specified below. Dimensions indicated on internally lined ducts are nominal inside dimensions.

1. Liner Insulation:

a. Duct liner complying with the requirements of Article “Duct Liner.”
b. Apply duct liner as specified in Article “Application of Liner in Rectangular, Round and Flat-Oval Ducts.” Terminate insulation where internally insulated duct connects to single-wall duct or uninsulated components. Terminate insulation and reduce outer duct diameter to inner liner diameter.
c. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation from dislocation by mechanical means.

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction

methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

1. All metal thicknesses shall be in even gauges using nominal to maximum thickness range in inches indicated in SMACNA HVAC DCS Appendix A.1.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: Black.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL and UL 181. Shall not promote or support microbial growth as tested in accordance with ASTM G21 and G22 for mold, fungus and bacteria growth.

1. Available Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ductmate Industries, Inc.

b. Carlisle Hardcast.
c. Foster Products.
d. Lindab Inc.
e. Lockformer.
f. McGill AirFlow LLC.
g. Ward Industries, Inc.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 6 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Service Temperature: Minus 25 to plus 175 deg F.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer. Gasket complying with MIL-C 18969B, Type II Class B, TT-C-1796 A, Type II Class B, and TTS-S-001657. Ductmate 440 or approved equal.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Fabricate and install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

G. Provide factory installed flanges. Shipments of loose flanges for field installation into spiral pipe will not be allowed.

H. All flat oval ducts shall be reinforced with trapeze type reinforcement, as recommended by the manufacturer, to limit wall deflection to 3/4" and reinforcement deflection to 1/4".

I. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines. Install duct systems in shortest route that does not obstruct usable space or block access for servicing building and its equipment.

J. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

K. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

L. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

M. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

N. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws

O. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

P. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

Q. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

R. Provide electrical isolation between dissimilar metals. Electrical isolation can be fluorinated elastomers or sponge-rubber gaskets.

S. Moisture Traps:

1. Construct watertight and airtight. Use single component type silicone sealants conforming to Federal Standard TT-S-001543.
2. Provide drains at base of moisture trap. Provide drain connections of one-inch (25 mm) pipe size corrosion resistant steel couplings welded to duct and provided with plug where drainage piping is not indicated. Provide drain lines with a trap of one inch (25 mm) greater depth than the positive or negative pressure in the duct but not less than 2 inches (50 mm).

T. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

F. Aesthetic Requirements for Exposed Ducts:

1. Paintable galvanized steel for Painting in compliance with Division 9.
2. Aligned spiral seams for the appearance of a continuous length of duct.
3. Reduce number of duct joints.
4. Duct connectors, hangers, and reinforcements as approved by Architect and Engineer that minimize their use or make them as inconspicuous as possible.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class B.
4. Outdoor, Return-Air Ducts: Seal Class B.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class B.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class B.

C. Seal ducts before external insulation is applied.

D. Circumferential and longitudinal seams of all fittings shall be continuous welded or continuous stitch welded on exposed installations and pressure applications equal to and greater than 5-inch wg both sides of all welds shall be painted to prevent corrosion.

E. All field joints, up to and including 60-inch diameter round, shall be made with a 2-inch slip-fit or sleeve coupling. Field joints with diameter 62-inch round and larger shall be joined with 2 x 2 x 3/16 Van Stone flanges for fittings and solid-welded flanges for spiral duct.

F. Pressure sensitive tapes shall not be used.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner, for 24-inches upstream of grilles, registers, and diffusers. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099123 "Interior Painting."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections, in presence of Construction Manager, TAB Agent, and Owner's Representative.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
    b. Supply Ducts with a Pressure Class of3-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
    c. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
    d. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
    e. Outdoor Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Test duct construction for leakage prior to installation. Each test section must have a minimum of 20 foot straight run, two elbows and a connection to the terminal or grilles and diffusers.
7. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports. Prepare a written report on findings and recommended corrective actions. After complete installation and test, the Test Engineer shall provide a signed letter of compliance with all recommendations for deficiency corrections and instructions.

3.8 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Supply Ducts:

1. Ducts Connected to VRF Indoor units, Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive 3-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Constant-Volume Air-Handling Units:

    a. Pressure Class: Positive 4-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 6 .
    d. SMACNA Leakage Class for Round and Flat Oval: 6.

3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

    a. Pressure Class: Positive 6-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 3 .

d. SMACNA Leakage Class for Round and Flat Oval: 3.

4. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 4-inch wg.
b. Minimum SMACNA Seal Class: A .
c. SMACNA Leakage Class for Rectangular: 3 .
d. SMACNA Leakage Class for Round and Flat Oval: 3 .

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12 .
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 6-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 4-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 3-inch wg.
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

3. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive or negative 3-inch wg.
    b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 6.
    d. SMACNA Leakage Class for Round and Flat Oval: 6.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive or negative 3-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Air-Handling Units:

    a. Pressure Class: Positive or negative 6-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 6.
    d. SMACNA Leakage Class for Round and Flat Oval: 6.

3. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive or negative 4-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 6.
    d. SMACNA Leakage Class for Round and Flat Oval: 6.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

G. Liner:
1. Transfer Ducts: Fibrous glass, Type II, 2 inches thick.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

    a. Velocity 1000 fpm or Lower:

        1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
        2) Mitered Type RE 4 without vanes.

    b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Only in restricted areas, Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Only in restricted areas, Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

J. Construct T's with radius of not less than 1-1/2 times width of duct on centerline. Do not use Bullhead Tees. Where not possible, provide air foil turning vanes. Where acoustical lining is indicated, provide acoustical turning vanes of perforated metal with glass fiber liner.

K. Offsets and Transitions:

1. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
2. Offset Type 3 (radiussed or ogee) complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-7, "Offsets and Transitions."
3. Offset Type 1 (angled), only where space restrictions do not permit using Type 3 offset, complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-7, "Offsets and Transitions."

L. Applications:

1. Use preformed single-wall insulated rectangular and/or round and/or flat-oval duct mains or branch ducts for supply air, return air, outside air, relief air from/to the fan coil units or air-handling units.
2. Use preformed single-wall insulated round and/or flat-oval and/or rectangular ducts for supply air and return air ducts of constant volume systems.
3. Use rectangular or round ducts for exhaust air.
4. Use rectangular lined ducts for transfer air.

END OF SECTION 23 3113

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Flange connectors.
6. Turning vanes.
7. Duct-mounted access doors.
8. Flexible connectors.
9. Flexible ducts.
10. Duct accessory hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product data showing compliance with ASHRAE 62.1.

C. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 where indicated OR unless otherwise G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Cesco Products; a divsion of MESTEK, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 6-inch wg.

E. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.

F. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.050-inch-thick aluminum sheet with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl, mechanically locked.

I. Blade Axles:

1. Material: Nonferrous metal.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Aluminum.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.

5. Screen Mounting: Front mounted in sleeve.

    a. Sleeve Thickness: 20 gage minimum.
    b. Sleeve Length: 6 inches minimum.

6. Screen Mounting: Rear mounted.
7. Screen Material: Aluminum.
8. Screen Type: Bird.
9. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

A. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Warming and Ventilating; a Mestek Architectural Group company.
    b. Flex-Tek Group.
    c. McGill AirFlow LLC.
    d. Nailor Industries Inc.
    e. Pottorff.
    f. Ruskin Company.
    g. Trox USA Inc.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames:

    a. Hat shaped.
    b. 0.094-inch-thick, galvanized sheet steel in galvanized steel ducts0.05-inch-thick stainless steel in stainless steel ducts.
    c. Mitered and welded corners.
    d. Flanges for attaching to walls and flangeless frames for installing in ducts.

6. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized or Stainless, roll-formed steel, 0.064 inch thick.

7. Blade Axles: Nonferrous metal.
8. Bearings:

    a. Oil-impregnated bronze.

b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Vinyl.
10. Jamb Seals: Cambered stainless steel.
11. Tie Bars and Brackets: Galvanized steel.
12. Accessories:

    a. Include locking device to hold single-blade dampers in a fixed position without vibration.

B. Low-Leakage, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Warming and Ventilating; a Mestek Architectural Group company.
    b. McGill AirFlow LLC.
    c. Nailor Industries Inc.
    d. Pottorff.
    e. Ruskin Company.
    f. Trox USA Inc.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
6. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
    d. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

7. Blade Axles: Nonferrous metal.
8. Bearings:

    a. Oil-impregnated bronze.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Vinyl.
10. Jamb Seals: Cambered stainless steel.
11. Tie Bars and Brackets: Aluminum.
12. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

C. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

B. Frames:

1. Hat or Angle shaped.
2. 0.094-inch-thick, galvanized sheet steel.
3. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Parallel- and opposed-blade design.
3. Galvanized-steel or Aluminum.
4. 0.064 inch thick single skin or 0.0747-inch-thick dual skin.
5. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings:

1. Oil-impregnated bronze or Oil-impregnated stainless-steel sleeve or Stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aire Technologies.
2. American Warming and Ventilating; a Mestek Architectural Group company.
3. Arrow United Industries.
4. Cesco Products; a divsion of MESTEK, Inc.
5. Greenheck Fan Corporation.
6. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.138 inch or 0.39 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.024-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.7 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

C. Vane Construction: Single wall for ducts up to 24 inches wide and double wall for larger dimensions.

2.9 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
   d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

B. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 3.0- to 8.0-inch wg.
5. Doors close when pressures are within set-point range.

6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch-thick, fibrous-glass or polystyrene-foam board.

2.10 DUCT ACCESS PANEL ASSEMBLIES

A. Labeled according to UL 1978 by an NRTL.

B. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

C. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

D. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

E. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

F. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd..
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

2.12 FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1, but not less than R-8.

B. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 8-inch wg positive or negative.
2. Maximum Air Velocity: 5000 fpm.
3. Temperature Range: Minus 20 to plus 250 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1, but not less than R-8.

2.13 FLEXIBLE DUCT CONNECTORS:

A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.14 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Compliance with ASHRAE/IESNA 90.1 includes Section 6.4.3.3.3 - "Shutoff Damper Controls," restricts the use of backdraft dampers, and requires control dampers for certain applications.

Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.
3. Install remote damper operators for volume dampers concealed above the non-accessible ceiling.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire dampers, to reset or reinstall fusible links. Access doors for access to fire dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream and downstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect diffusers or light troffer boots to ducts directly or with maximum 36-inch lengths of flexible duct clamped or strapped in place, only where shown or approved.

O. Connect flexible ducts to metal ducts with draw bands.

P. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 3300

SECTION 23 3423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Centrifugal ventilators - roof upblast and sidewall.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
   2. Rated capacities, operating characteristics, and furnished specialties and accessories.
   3. Certified fan performance curves with system operating conditions indicated.
   4. Certified fan sound-power ratings.
   5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   6. Material thickness and finishes, including color charts.
   7. Dampers, including housings, linkages, and operators.
   8. Prefabricated roof curbs.
   9. Fan speed controllers.

B. Shop Drawings:

   1. Include plans, elevations, sections, and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.
   4. Design Calculations: Calculate requirements for selecting vibration isolators.

C. Delegated Design Submittal: For unit hangars and supports 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. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, or BIM model, drawn to scale, showing the items described in this Section and coordinated with all building trades.

B. Product Certificates: Submit certificates that specified equipment will withstand required wind forces, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For HVAC power ventilators to include in normal and emergency operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.2 CENTRIFUGAL VENTILATORS - ROOF UPBLAST

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. PennBarry; division of Air System Components.

B. Configuration: Centrifugal roof upblast ventilator.

C. Housing: Removable spun aluminum; square, one-piece aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Accessories:

1. Variable-Frequency Motor Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, NEMA 3R, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or stainless-steel wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
5. Motorized Dampers: Low-leakage, parallel-blade, aluminum dampers mounted in curb base or duct plenum with electric actuator; wired to close when fan stops.
6. Vari-Flow Air Balance Kit (VFABK): An interface to integrate and simplify the interconnection of Vari-Flow motors and controls. A convenient point to set the speed range over which the Vari-Flow motor will operate. Provide with external signal capability with Vari-Flow motors. The VFABK contains an integral 24V control transformer. Include convenient terminals for landing Vari-Flow motors and controls as well as auxiliary control of motor operated dampers. Include means for remote on/off control. Status is indicated by a tricolor LED light.

F. Prefabricated Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in raised cant and mounting flange Manufactured to accommodate roof slope.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Electronically Commutated Motors:

1. Motor enclosures: Open type
2. DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start, and 3 phase induction type motors.
3. Permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
5. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal. Integral mounted and wired transformer.
6. Motor shall be a minimum of 85% efficient at all speeds.

C. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

2.4 SOURCE QUALITY CONTROL

A. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.

B. AMCA Certification for Fan Aerodynamic Performance Ratings: Test, rate, and label in accordance with AMCA 211.

C. AMCA Certification for Fan Energy Index (FEI): Test, rate, and label in accordance with AMCA 211.

D. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install power ventilators level and plumb.

B. Equipment Mounting:

1. Secure roof-mounted fans to roof curbs with zinc-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.

2. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliance, and essential data.
2. Location: Accessible and visible location.

3.2 DUCTWORK CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 STARTUP SERVICE:

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
4. Verify that cleaning and adjusting are complete.
5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
6. For belt-drive fans, disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
7. Adjust belt tension.
8. Adjust damper linkages for proper damper operation.
9. Verify lubrication for bearings and other moving parts.
10. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
11. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
12. Shut unit down and reconnect automatic temperature-control operators.
13. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

D. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties.
3. Fans and components will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 23 3423

SECTION 23 3439 - HIGH-VOLUME, LOW-SPEED FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes low-volume, low-speed fans.

1.2 DEFINITIONS

A. HVLS - High volume, low speed.

B. LVLS – Low Volume, Low Speed.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Show dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and details, drawn to scale and coordinated with each other, using input from installers of the items involved.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of fans that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Motor, Including Controls: Five year(s) from date of Substantial Completion.
b. For Parts, Including Blades and Hub: Five year(s) from date of Substantial Completion.

c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Listed and labeled to UL 507.

C. CSA Compliance: Listed and labeled to CSA C22.2, No. 113.

D. Comply with NFPA 13 requirements for LVLS fans.

E. AMCA Compliance:

1. Test LVLS fans according to AMCA 230.
2. Certify LVLS fan performance according to AMCA 211.

F. Performance Data: Comply with ANSI 230 test procedure standard, based on five rating points: 20-, 40-, 60-, 80-, and 100-percent of maximum speed. Comply with AMCA 211 for publication of performance data.

2.2 CAPACITIES AND CHARACTERISTICS

A. Fan:

1. Type: Low Speed, Selectable.
2. Number of Fan Blades: As Scheduled.
3. Fan Diameter: As Scheduled.
4. Maximum Fan Speed: As Scheduled.

B. Motor: As Scheduled.

2.3 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Big Ass Solutions.
2. Blue Giant Equipment Corporation.
3. Hunter Fan Company; Industrial & Commercial Division.
4. Kelley; Entrematic; ASSA ABLOY.
5. MacroAir.
6. Thermotek.

B. Source Limitations: Obtain LVLS fans from single source from single manufacturer.

2.4 LOW-VOLUME, LOW-SPEED FANS

A. Description: Factory-assembled and -tested horizontal, non-ducted fan unit, consisting of small-diameter blade set, direct-drive electric motor, with variable-speed motor controller.

1. Provide fan designed to circulate low air volume, vertically, at low velocity.
2. Maximum Operating Temperature: 122 deg F.
3. Frame:

    a. Material: Aluminum or Galvanized steel.

        1) Finish: Powdercoat or Thermoset, polyester powder paint.

4. Diameter: 4.3 feet.
5. Blades: Airfoil type.

    a. Quantity: 4.
    b. Material: Aluminum.

        1) Blade Finish: As selected by Architect.

6. Motor: integral to fan frame.
7. Wiring and Controls Enclosure:

    a. NEMA 250, Class 1.
    b. Material: Aluminum.

        1) Enclosure Finish: Powdercoat or Thermoset.

    c. Grounded.

8. Controls: Provide wall-mounted keypad.

    a. Provide manual, variable speed motor controller speed control.
9. Standard Mounting Bracket: Steel beam/steel angle.
10. Accessories:

    a. Mounting extension tube.

PART 3 - EXECUTION

3.1 INSTALLATION OF LOW-SPEED FANS

A. Examine conditions for compliance with requirements for installation tolerances and other conditions affecting LS fan performance, maintenance, and operations.

B. Fan locations indicated on Drawings are approximate. Determine exact locations before roughing-in for mounting, control, and electrical connections.

C. Install fan according to manufacturer's published instructions.

D. Comply with NECA 1 and NFPA 70.

E. Comply with NFPA 13 for installation of fans and maximum allowable fan diameter. Center LVLS fans between four adjacent sprinklers. Minimum vertical clearance from LVLS fan to sprinkler deflector is 3 feet.

F. Comply with NFPA 72 and interlock fans to shut down upon receiving an alarm from fire alarm system.

G. Equipment Mounting:

1. Anchor fan to building structure with manufacturer's recommended mounting bracket for installed condition.
2. Comply with requirements for hangers and supports specified in Section 23 0529 "Hangers and Supports for HVAC Piping and Equipment."
3. Comply with requirements for vibration isolation devices specified in Section 23 0548.13 "Vibration Controls for HVAC."

H. Install unit to permit access for maintenance.

I. Install parts and accessories shipped loose.

J. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that fan is secure on mountings and supporting devices and that connections to electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
3. Verify proper motor rotation direction and free fan rotation.
4. Check bearing lubrication.
5. Verify proper fan rotation. Set rotation selector to blow vertically downward during heating season and vertically upward during cooling season.

3.2 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 26 0553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

E. Install power wiring to field-mounted electrical devices, furnished by fan manufacturer, but not factory mounted.

3.3 CONTROL CONNECTIONS

A. Connect control wiring to field-mounted control devices.

B. Connect control wiring according to Section 26 0523 "Control-Voltage Electrical Power Cables."

C. Connect control interlock wiring between LVLS fan and other equipment to provide a complete and functioning system.

D. Connect control wiring between fan unit control interface and control system to provide remote control and monitoring.

E. Install control devices furnished by manufacturer, but not factory mounted.

F. Install control wiring to field-mounted control devices, furnished by fan manufacturer, but not factory mounted.

G. Protect installed units from damage caused by other work.

3.4 FIELD QUALITY CONTROL

A. Testing Agency, Owner Engaged: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency, Contractor Engaged: Engage a qualified testing agency to perform tests and inspections.

C. Perform the following tests and inspections:

1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Fan or components will be considered defective if fan or components do not pass tests and inspections.

E. Prepare and submit test and inspection reports.

3.5 ADJUSTING

A. Comply with requirements in Section 23 0593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.6 CLEANING

A. Clean equipment externally; remove coatings applied for protection during shipping and storage, foreign material, and oily residue according to manufacturer's written instructions. Following manufacturer's cleaning procedures, and clean with manufacturer-recommended cleaning products.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain LVLS fans.

END OF SECTION 23 3439

SECTION 23 3713.13 - AIR DIFFUSERS

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. Louver face diffusers.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including aspiration ability, temperature and velocity traverses, throw and drop, static-pressure drop, and noise ratings. Indicate each selection on data sheets.
2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified. Actual size of smallest diffuser indicated.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of diffusers, registers, and grilles of types and capacities required, whose products have been in satisfactory use in similar service for not less than five years.

B. Codes and Standards:

1. ASHRAE Compliance: Test and rate diffusers, registers, and grilles in accordance with ASHRAE 70 "Method of Testing for Rating the Performance of Air Outlets and Inlets."
2. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

C. Single Source Responsibility: Obtain diffusers, registers, and grilles through one source from a single manufacturer where alike in one or more respects with regard type, design, or factory-applied color finish.

D. Design Concept: The drawings indicate types of diffusers based on the specific descriptions, manufacturers, models, and numbers indicated.

1. Refer to the Conditions of the Contract and Division 1 specification sections for the requirements of product substitution.
2. Where more than one manufacturer is named, only the basis-of-design manufacturer's item has been verified as suitable.

PART 2 - PRODUCTS

2.1 LOUVER FACE DIFFUSERS (1D1, 2D1, 3D1, 4D1, 1D, 2D, 3D, 4D)

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Anemostat Products; a Mestek company.
2. METALAIRE, Inc.
3. Nailor Industries Inc.
4. Price Industries.
5. Titus.
6. Tuttle & Bailey.

B. Description: Four or more concentric removable core with gasket designed to deliver air in a generally horizontal direction without excess smudging of the ceiling. The ceiling diffusers shall be of the restricted multi-orificed jet induction and air mixing type consisting of round edged louver sections with built-in diffusing vanes. Diffusing vanes welded and mechanically fastened to the adjacent louver sections to make a rigid unit. Air diffusion vanes at opposite angles of core of concentric louvers shall create turbulent discharge air jets for high induction and rapid temperature equalization. Devices shall be specifically designed for variable-air-volume flows.

C. Material: Steel.

D. Finish: Baked enamel, color selected by Architect.

E. Face Size: 24 by 24 inches. Include square or rectangular housing extended to form a panel to fit in ceiling system module, core of square or rectangular concentric louvers, square or round duct connection.

F. Mounting: Surface with beveled frame or T-bar with mounting panel.

G. Pattern: One-way, Two-way, Two-way corner, Three-way, Four-way core style as indicated.

H. Dampers: Do not install in neck. Manual volume damper specified in Section 233300.

I. Accessories:

1. Square to round neck adaptor factory welded to the square or rectangular neck to accept round duct.

2. Adjustable pattern vanes.
3. Throw reducing vanes.
4. Plaster ring.
5. Safety chain.
6. Combination adjustable opposed blade damper and fusible link fire damper with UL approved link and assembly designed to meet requirements of NFPA 90A for the fire rated ceilings.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers level and plumb.

B. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module 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.

C. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

D. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

E. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of diffusers with other work.

F. Support diffusers installed in grid ceiling systems independent of the ceiling hardware.

3.3 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers that have damaged finishes.

END OF SECTION 23 3713.13

SECTION 23 3713.23 - AIR REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Adjustable blade face registers and grilles.
2. Fixed face registers and grilles.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static pressure drop, and noise ratings. Indicate each selection on data sheets.
2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of diffusers, registers, and grilles of types and capacities required, whose products have been in satisfactory use in similar service for not less than five years.

B. Codes and Standards:

1. ASHRAE Compliance: Test and rate diffusers, registers, and grilles in accordance with ASHRAE 70 "Method of Testing for Rating the Performance of Air Outlets and Inlets."
2. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

C. Single Source Responsibility: Obtain diffusers, registers, and grilles through one source from a single manufacturer where alike in one or more respects with regard type, design, or factory-applied color finish.

D. Design Concept: The drawings indicate types of diffusers based on the specific descriptions, manufacturers, models, and numbers indicated.

1. Refer to the Conditions of the Contract and Division 1 specification sections for the requirements of product substitution.
2. Where more than one manufacturer is named, only the Basis-of-Design manufacturer's item has been verified as suitable.

PART 2 - PRODUCTS

2.1 REGISTERS

A. Adjustable Blade Face Register (SR):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tuttle & Bailey DQM Series or comparable product by one of the following:

    a. Anemostat Products; a Mestek company.
    b. Hart & Cooley Inc.
    c. Krueger.
    d. METALAIRE, Inc.
    e. Price Industries.
    f. Titus.

2. Material: Aluminum or Stainless steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Fixed horizontal, streamlined foil-shaped 16 gauge bars spaced on 3/4 inch center with 42-degree face deflection. 75 percent minimum free area. Extruded brace bars to assure rugged heavy-duty unit.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Rear-diffusing vanes to achieve high entrainment rate and rapid temperature equalization.
7. Frame: 1-1/4 inches wide.
8. Mounting: Countersunk screw with security fasteners or Concealed.
9. Damper Type: Aluminum, adjustable opposed blade in non-rated wall NRTL listed, opposed blade, spring closing, aluminum, and with fusible link for 160 deg F in rated wall.

B. Fixed Face Register (ER1):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tuttle & Bailey Model A117DG or comparable product by one of the following:

a. Anemostat Products; a Mestek company.
b. Hart & Cooley Inc.
c. Krueger.
d. Price Industries.
e. Titus.

2. Material: Extra heavy duty extruded aluminum.
3. Finish: Satin anodized or Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.
5. Face Arrangement: Perforated core.
6. Core Construction: Integral.
7. Frame: 1-1/4 inches wide.
8. Mounting: Countersunk screw with security fasteners or Concealed.
9. Damper Type: NRTL listed, opposed blade, spring closing, and with fusible link for 160 deg F.

2.2 GRILLES

A. Adjustable Blade Face Grille (SG):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tuttle & Bailey DQM Series or comparable product by one of the following:

a. Anemostat Products; a Mestek company.
b. Hart & Cooley Inc.
c. Krueger.
d. METALAIRE, Inc.
e. Price Industries.
f. Titus.

2. Material: Aluminum or Stainless steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Fixed horizontal, streamlined foil-shaped 16 gauge bars spaced on 3/4 inch center with 42-degree face deflection. 75 percent minimum free area. Extruded brace bars to assure rugged heavy-duty unit.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Rear-diffusing vanes to achieve high entrainment rate and rapid temperature equalization.
7. Frame: 1-1/4 inches wide.
8. Mounting: Countersunk screw with security fasteners or Concealed.

B. Fixed Face Grille (EG1):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tuttle & Bailey Model A70D or comparable product by one of the following:

a. Anemostat Products; a Mestek company.
b. Hart & Cooley Inc.

c. Krueger.
d. Price Industries.
e. Titus.

2. Material: Extra heavy duty extruded aluminum.
3. Finish: Satin anodized or baked enamel, color selected by Architect.
4. Face Blade Arrangement: Fixed horizontal, streamlined foil-shaped 16-gauge bars spaced on 3/4 inch center with 42-degree face deflection. 75 percent minimum free area. Extruded brace bars to assure rugged heavy-duty unit.
5. Core Construction: Integral.
6. Frame: 1-1/4 inches wide.
7. Mounting: Countersunk screw with security fasteners or Concealed.

C. Fixed Grid Core Grille (EG / RG):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tuttle & Bailey; VPER or a comparable product by one of the following:

a. Hart & Cooley Inc.
b. Krueger.
c. Nailor Industries Inc.
d. Price Industries.
e. Titus.

2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: Indented horizontal fins. 81 percent free area.
5. Core Construction: Fixed.
6. Frame: Aluminum channel, 1 inch wide with mitered corners.
7. Mounting: Surface.
8. Accessory: None.

D. Fixed Grid Core Grille (TG):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tuttle & Bailey; GAV or a comparable product by one of the following:

a. Hart & Cooley Inc.
b. Krueger.
c. Nailor Industries Inc.
d. Price Industries.
e. Titus.

2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core with mechanically locked in margins. 12 by 12 inches or 24 by 12 inches or 24 by 24 inches as indicated. Include square or rectangular housing extended to form panel to fit in ceiling system module, core of grid, square or round duct connection.

5. Core Construction: Removable or hinged face panel.
6. Frame: 1 inch wide.
7. Mounting Frame: Filter where indicated. Surface or T-bar with mounting panel.
8. Mounting: Lay in.

E. Fixed Grid Core Grille (TG):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tuttle & Bailey; CRE510 or a comparable product by one of the following:

    a. Hart & Cooley Inc.
    b. Krueger.
    c. Nailor Industries Inc.
    d. Price Industries.
    e. Titus.

2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core with mechanically locked in margins. 12 by 12 inches or 24 by 12 inches or 24 by 24 inches as indicated. Include square or rectangular housing extended to form panel to fit in ceiling system module, core of grid, square or round duct connection.
5. Core Construction: Removable or hinged face panel.
6. Frame: 1 inch wide.
7. Mounting Frame: Filter where indicated. Surface or T-bar with mounting panel.
8. Mounting: Lay in.
9. Accessory:

    a. Factory welded, square to round transitions attached to the square or rectangular necks of the grille to accept round duct.
    b. Filters: Extended-surface, disposable, pleated filters: Provide air filter for each grille where plenum return air is used and where indicated.

        1) Description: Factory-fabricated, dry, extended-surface filters with holding frames.
        2) Media: Fibrous material formed into deep V-shaped pleats and held by self-supporting wire frames, minimum of 14 pleats per linear foot.
        3) Frame: Fire-retardant, 3/4-inch (19mm) particle board or galvanized steel, with suitable fasteners and gaskets to hold media and media frame and to prevent unfiltered air from passing between media frames and holding devices.
        4) 1" thick pleated, MERV 8 efficiency, 90-92 percent arrestance, as determined by ASHRAE Standard 52.1.
        5) UL 900, Class 2 listed and labeled.
        6) Airflow resistance with clean media shall not exceed 0.45-inch w.g. at face velocity of 500 fpm maximum.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Wall and Ceiling Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall or ceiling systems, and that are specifically manufactured to fit into wall or ceiling construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall and ceiling construction, which will contain each type of wall and ceiling register and grille.

C. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

D. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 3713.23

SECTION 23 3723 - HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Louvered-penthouse ventilators.
2. Goosenecks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. For louvered-penthouse ventilators specified to bear AMCA seal, include printed catalog pages, showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For gravity ventilators.

1. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.
2. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.5 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft., acting inward or outward.
2. Snow Load: Unit to withstand a minimum of 20-lbf/sq. ft. snow load.

B. ASHRAE 62.1 Compliance: Section 5, "Systems and Equipment" and Section 7, "Construction and System Start-up."

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Change (Range):
   a. Ambient: 120 deg F.
   b. Material Surfaces: 180 deg F.

D. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

2.2 FABRICATION

A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

2.3 LOUVERED-PENTHOUSE VENTILATORS

A. Description: Multitier rectangular louvered penthouse for intake air.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Loren Cook Company or comparable product by one of the following:

1. Greenheck Fan Corporation.
2. Ruskin Company.

C. Source Limitations: Obtain louvered-penthouse ventilators from single manufacturer.

D. Construction:

1. Material: All-welded assembly with 4-inch-deep louvers, mitered corners, and aluminum sheet roof.
2. Frame and Blade Material: Extruded aluminum, of thickness required to comply with structural performance requirements, but not less than 0.080 inch for frames and 0.080 inchfor blades with condensate deflectors.
3. Insulation: Mineral-fiber insulation and vapor barrier.

4. Wind-Driven Rain Performance: Not less than 95 percent effectiveness when subjected to a rainfall rate of 3 inches per hour and a wind speed of 29 mph at a free-area intake velocity of 500 fpm.
5. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.
6. Exterior Corners: Prefabricated corner units with mitered and welded blades and with fully recessed mullions at corners.
7. Insect Screening: Aluminum, 18-by-16 mesh wire.

E. Dampers:

1. Location: Curb damper tray.
2. Control: Motorized.
3. Tray: Provide damper tray or shelf with opening 3 inches less than interior curb dimensions indicated.

F. Roof Curbs: Aluminum or Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Built-in raised cant and mounting flange.
2. Overall Height: 24 inches.

2.4 GOOSENECKS

A. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 6-5; with a minimum of 0.052-inch-thick, galvanized-steel sheet.

B. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch.

C. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas, and repair galvanizing according to ASTM A780/A780M. Apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.
    a. Color and Gloss: As selected by Architect from manufacturer's full range.

D. Roof Curbs: Aluminum or Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Built-in raised cant and mounting flange.
2. Overall Height: 18 inches.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A653/A653M, G90 zinc coating, mill phosphatized.

D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

E. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

B. Secure gravity ventilators to roof curbs with zinc-plated hardware, that comply with the wind and seismic fastening requirements. Use concealed anchorages where possible. Refer to Section 07 7200 "Roof Accessories."

C. Install goosenecks on curb base where throat size exceeds 9 by 9 inches.

D. Install gravity ventilators with clearances for service and maintenance.

E. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

F. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 07 9200 "Joint Sealants" for sealants applied during installation.

G. Label gravity ventilators according to requirements specified in Section 23 0553 "Identification for HVAC Piping and Equipment."

H. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

I. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes, so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

J. Refer to Section 07 7200 "Roof Accessories" for flashing and counterflashing of roof curbs.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in Section 23 3113 "Metal Ducts." Drawings indicate general arrangement of ducts and duct accessories.

3.3 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION 23 3723

SECTION 23 8129 - VARIABLE-REFRIGERANT-FLOW HVAC 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 complete VRF HVAC system(s) including, but not limited to, delegated design and the following components to make a complete operating system(s) according to requirements indicated:
1. Indoor, concealed, ceiling-mounted units for ducting.
2. Indoor, recessed, ceiling-mounted units.
3. Indoor, dedicated outdoor air ventilation units.
4. Outdoor, air-source heat recovery units.
5. Heat recovery control units.
6. System controls.
7. System refrigerant and oil.
8. System condensate drain piping.
9. System refrigerant piping.
10. Metal hangers and supports.
11. Metal framing systems.
12. Fastener systems.
13. Pipe stands.
14. Miscellaneous support materials.
15. Piping and tubing insulation.
16. System control cable and raceways.

1.3 DEFINITIONS

A. Heat Recovery System Operation: System capable of operation with simultaneous heating and cooling zones that transfer heat between zones. Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. Air-source VRF system shall be designed specifically for cold weather heating performance. Bidding “over-sized” systems (providing outdoor units with greater nominal tonnage than the basis of design) to meet system heat requirements is permissible on a voluntary alternate basis only and bid must be accompanied by equipment PLR curves and project energy analysis (completed with Trace 700 or EnergyPro) quantifying energy penalty resulting from associated cycling of over-sized system during mild ambient temperatures. To ensure occupant comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 1.8 degrees F from set point for ten minutes.

B. HRCU (BCU): Heat Recovery Control Unit. HRCUs are used in heat recovery VRF HVAC systems to manage and control refrigerant between indoor units to provide simultaneous heating and cooling zones. "Heat Recovery Control Unit" is the term used by ASHRAE for what different manufacturers term as branch circuit controller, branch selector box, changeover box, flow selector unit, mode change unit, and other such terms.
   1. No additional branch circuit controllers (or comparable branch devices) than shown on the drawings/schedule may be connected to any one outdoor unit. Contractors proposing alternate systems requiring more branch devices than those included as the basis of design are responsible for additional piping & electrical costs and are required to identify additional costs & installation time required of other trades with their bid.

C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

D. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

E. Three-Pipe System Design: One high pressure refrigerant vapor line, one low pressure refrigerant vapor line, and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One liquid line and refrigerant vapor line connect HRCUs to associated indoor units. Three-Pipe Systems are not acceptable.

F. Two-Pipe System Design: One refrigerant vapor line and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One refrigerant liquid line and refrigerant vapor line connect HRCUs to associated indoor units. HRCUs used in two pipe systems act as an intermediate heat exchanger and include diverting valves and gas/liquid separators to move high- and low-pressure refrigerant between indoor units.

G. VRF: Variable refrigerant flow.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for indoor and outdoor units and for HRCUs.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
   3. Include operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.

4. Include description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
5. Include system operating sequence of operation in narrative form for each unique indoor- and outdoor-unit and HRCU control.
6. Include description of control software features.
7. Include total refrigerant required and a comprehensive breakdown of refrigerant required by each system installed.
8. Include refrigerant type and data sheets showing compliance with requirements indicated.
9. For system design software.
10. Indicate location and type of service access.

B. Sustainable Design Submittals:
1. Product Data for EA Prerequisite 2, "Minimum Energy Performance": Indicating compliance with minimum energy performance requirements.
2. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
3. ASHRAE/IES 90.1 compliance.
4. Air-Balance Report: Documentation indicating that Work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
5. Product Data: For refrigerants, indicating compliance with refrigerant management practices.
6. Product Data for EA Credit "Optimize Energy Performance": Indicating that system meets efficiency requirements.
7. Product Data for EA Credit "Advanced Energy Metering": For continuous metering equipment for energy consumption.
8. Product Data for EQ Credit "Acoustic Performance": Documentation indicating that systems and equipment comply.
9. Product Data for Credit IEQ 1, "Outdoor Air Delivery Monitoring": Documentation indicating that systems, equipment, and controls comply.
10. Thermal Comfort: Product Data indicating that systems, equipment, and controls comply.
11. Product Data for Credit IEQ 7.1, "Thermal Comfort - Design": Documentation indicating that systems, equipment, and controls comply.

C. Shop Drawings: For VRF HVAC systems, approved by the VRF manufacturer's authorized representative.
1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings. Scaled piping layouts with radial and linear dimensions identifying pipe type. Identify each refrigerant circuit and indicate refrigerant type and mass. Indicate piping expansion components and directions of thermal expansion.

5. Include diagrams for power, signal, and control wiring.

D. Delegated-Design Submittals:
1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.
2. Include design calculations with corresponding diagram of refrigerant piping and tubing sizing and expansion for each system installed.
3. Include design calculations with corresponding floor plans indicating that refrigerant concentration limits are within allowable limits of ASHRAE 15 and governing codes.
4. Include calculations showing that system travel distance for refrigerant piping and controls cabling are within horizontal and vertical travel distances set by manufacturer. Provide a comparison table for each system installed.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, sections, and details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Suspended ceiling components.
2. Structural floors, roofs and associated members to which equipment, piping, ductwork, cables, and conduit will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Wall-mounted controllers located in finished space showing relationship to light switches, fire-alarm devices, and other installed devices.
5. Size and location of access doors and panels installed behind walls and inaccessible ceilings for products installed behind walls and requiring access.
6. Items penetrating finished ceiling including the following:
a. Luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Service access panels.
f. Any other ceiling mounted items.

B. Qualification Data:
1. For Installer: Certificate from VRF HVAC system manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
a. Retain copies of Installer certificates on-site and make available on request.
2. For VRF HVAC system manufacturer.
3. For VRF HVAC system provider.
4. Ozone Depleting Substances Technician Certification: Certify all technicians working on VRF equipment that contain ozone depleting refrigerants as a Section 608 Technician to meet requirements in 40 CFR 82, Subpart F. Submit

copies of technician certifications at least 14 calendar days prior to work on any equipment containing these refrigerants.

C. Product Certificates: For each type of product.

D. Product Test Reports: Where tests are required, for each product, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

E. Source quality-control reports.

F. Field quality-control reports.

G. Sample Warranties: For manufacturer's warranties.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VRF HVAC systems to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 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. Filters:
   a. One set(s) for each unit with replaceable filters.
   b. One set(s) for each unit type and unique size of washable filters.
2. Indoor Units: One for each unique size and type installed.
3. Controllers for Indoor Units: One for each unique controller type installed.
4. Any specialized tools, equipment, or software that owner will need to operate, adjust, maintain, and diagnose the equipment.

1.9 SUBSTITUTE MANUFACTURER'S SUBMITTALS

A. The substitute equipment supplier shall provide to the mechanical contractor a complete equipment data package. This package shall include, but is not limited to, equipment capacities at the design condition, power requirements, indoor units CFM/static pressures, fan curves, installation requirements, and physical dimensions. Nominal performance data is not acceptable.

B. The mechanical contractor shall request and receive the equipment data package and submit this package in compliance with substitution procedure and submittals requirements.

C. The mechanical contractor shall list the equipment supplier and submit the required data package with the substitution request detailing a complete comparison of the proposed substitute equipment to the specified equipment and the associated cost reduction of the substitute equipment. The contractor bids a substitute manufacturer with full knowledge that that manufactures product may not be acceptable or approved.

D. The substitute equipment supplier shall furnish a complete drawing package to the mechanical contractor. The drawing format shall be .dxf/,dwg or equivalent, on 30"x42" sheets. The architectural floor plans documents will be made available in electronic format for use by the equipment supplier in preparing their drawings. The substitute equipment supplier shall prepare the following drawings:

1. XXX HVAC Floor Plans
2. XXX HVAC Refrigerant Piping Plans
3. XXX HVAC Refrigerant Piping/Controls Details
4. XXX HVAC Details
5. XXX HVAC Schedules

E. The substitute equipment supplier shall draft all piping circuits, components, overall building control schematic, detailed control wiring diagrams, system details and schedules for their system. The drawings shall convey all requirements to successfully install the substitute equipment supplier's system.

F. Provide (5) drawing package sets plotted on 20 lb. bond paper. Provide (5) drawing packages in electronic format (.dxf and PDF files) on CD.

G. The submitted documents shall be complete system designs and show no less information than the HVAC equipment/controls contract bid documents.

H. Provide the following scorecard(s) with the substitution submittal for review by the Owner and Engineer for their respective system(s).

Item #	Item Description	Manufacturer's Response	Response Date
1	# compressors overall # non-inverter compressors		
2	Statistical probability of warranty period compressor failure based on # compressors above and 1% warranty failure rate for each compressor for all manufacturers.		
3	# VRF systems as proposed		
4	# Branch devices included		
5	Can additional units be added or existing indoor units be replaced with units of a different size without piping changes between the branch device and outdoor unit?		

6	How is condensate formation in the branch device managed? (provide photos of branch device interior showing serviceable components)		
7	List heating/cooling performance derate factors applied to systems performance for: Ambient Temperature Indoor Temperature Piping Length & Vertical Separation Defrost		
8	Heating amount & percentage delivered during defrost		
9	Total refrigerant charge of systems provided		
10	Is commonly available polyester (POE) used in the system?		
11	# manufacturer (or respective US division) employees based within 200 miles of job site		
12	# local distributors stocking parts within 200-mile radius		
13	# years local supplier has been selling VRF brand		

1.10 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Nationally recognized manufacturer of VRF HVAC systems and products.
   2. Shipped VRF HVAC systems with similar requirements to those indicated for a continuous period of 10 years within time of bid.
   3. VRF HVAC systems and products that have been successfully tested and in use on at least five completed projects.
   4. Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.
   5. Having full-time in-house employees for the following:
      a. Product research and development.
      b. Product and application engineering.
      c. Product manufacturing, testing, and quality control.
      d. Technical support for system installation training, startup, commissioning, and troubleshooting of installations.
      e. Owner training.

B. Factory-Authorized Service Representative Qualifications:
   1. Authorized representative of, and trained by, VRF HVAC system manufacturer.
   2. In-place facility located within 50 miles of Project.

3. Demonstrated past experience with products being installed for period within five consecutive years before time of bid.
4. Demonstrated past experience on five projects of similar complexity, scope, and value.
    a. Each person assigned to Project shall have demonstrated past experience.
5. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
6. Service and maintenance staff assigned to support Project during warranty period.
7. Product parts inventory to support ongoing system operation for a period of not less than five years after Substantial Completion.
8. VRF HVAC system manufacturer's backing to take over execution of Work if necessary, to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.
1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
2. Installer certification shall be valid and current for duration of Project.
3. Retain copies of Installer certificates on-site and make available on request.
4. Each person assigned to Project shall have demonstrated past experience.
    a. Demonstrated past experience with products being installed for period within five consecutive years before time of bid.
    b. Demonstrated past experience on five projects of similar complexity, scope, and value.
5. Installers shall have staffing resources of competent, trained, and experienced full-time employees that are assigned to execute work according to schedule.

D. ISO Compliance: System equipment and components furnished by VRF HVAC system manufacturer shall be manufactured in an ISO 9001 and ISO 14001 facility.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in a clean and dry place.

B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.

C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.

D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.
1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.

2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remover coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.

E. Replace installed products damaged during construction.

1.12 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures.
b. Faulty operation.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
2. Warranty Period:
a. For Compressor: Ten year(s) from date of Substantial Completion.
b. For Parts, Including Controls: 10 year(s) from date of Substantial Completion.
c. For Labor: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Mitsubishi Electric or Trane HVAC US LLC, R2 Series.
1. No Substitutions.

B. Source Limitations: Obtain products from single source from single manufacturer including, but not limited to, the following:
1. Indoor and outdoor units, including accessories.
2. Controls and software.
3. HRCUs.
4. Dedicated outdoor air units.
5. Refrigerant isolation valves.
6. Specialty refrigerant pipe fittings.

2.2 SYSTEM DESCRIPTION

A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, HRCUs, outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.
1. Two-pipe system design.
2. System(s) operation, Simultaneous heating and cooling with heat recovery as indicated on Drawings and Specifications.

3. Each system with one refrigerant circuit shared by all indoor units connected to system.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. AHRI Compliance: System and equipment performance certified according to AHRI 1230 and products listed in AHRI directory.

D. ASHRAE Compliance:
1. ASHRAE 15: For safety code for mechanical refrigeration.
2. ASHRAE 62.1: For indoor air quality.
3. ASHRAE 135: For control network protocol with remote communication.
4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.

E. UL Compliance: Comply with UL 1995.

F. Energy Star Label.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design complete and operational VRF HVAC system(s) complying with requirements indicated.
1. Provide system refrigerant calculations.
   a. Refrigerant concentration limits shall be within allowable limits of ASHRAE 15 and governing codes.
   b. Indicate compliance with manufacturer's maximum vertical and horizontal travel distances. Prepare a comparison table for each system showing calculated distances compared to manufacturer's maximum allowed distances.
2. Include a mechanical ventilation system and gas detection system as required to comply with ASHRAE 15 and governing codes.
3. System Refrigerant Piping and Tubing:
   a. Arrangement: Arrange piping to interconnect indoor units, HRCUs, and outdoor unit(s) in compliance with manufacturer requirements and requirements indicated.
   b. Routing: Conceal piping above ceilings and behind walls to maximum extent possible.
   c. Sizing: Size piping system, using a software program acceptable to manufacturer, to provide performance requirements indicated. Consider requirements to accommodate future change requirements.
4. System Controls:
   a. Network arrangement.
   b. Network interface with other building systems.
   c. Product selection.
   d. Sizing.

B. Service Access:
   1. Provide and document service access requirements.
   2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
   3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
   4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
   5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
   6. Comply with OSHA regulations.

C. System Design and Installation Requirements:
   1. Design and install systems indicated according to manufacturer's recommendations and written instructions.
   2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.

D. System Adaptability to Future Changes: Arrange and size system refrigerant piping to accommodate future changes to system without having to resize and replace existing refrigerant piping.
   1. Future changes to system(s) indicated on Drawings.
   2. Each branch circuit shall accommodate addition of two indoor unit(s) with unit capacity equal to largest indoor unit connected to the branch circuit.
   3. Each branch circuit shall accommodate deletion of one indoor unit(s) with unit capacity equal to average indoor unit connected to the branch circuit.
   4. Minimum 25 percent spare capacity for the entire system.

E. Isolation of Equipment: Provide isolation valves to isolate each HRCU indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.

F. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:
   1. Not less than 50 percent.
   2. Not more than 110 percent.
   3. Range acceptable to manufacturer and Engineer.

G. System Turndown: Stable operation down to 20 percent of outdoor-unit capacity.

H. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.

I. Outdoor Conditions:

1. Suitable for outdoor ambient conditions encountered.
   a. Design equipment and supports to withstand wind loads of governing code and ASCE/SEI 7.
   b. Design equipment and supports to withstand snow and ice loads of governing code and ASCE/SEI 7.
   c. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.
2. Maximum System Operating Outdoor Temperature: See Drawings.
3. Minimum System Operating Outdoor Temperature: Minus 25 deg F in heating mode and 23 deg F in cooling mode without any additional low ambient controls.
4. Defrost all circuits simultaneously in order to resume full heating more quickly during extreme low ambient temperatures (below 23 deg. F). Partial defrost, also known as hot gas defrost which allows reduced heating output during defrost, is permissible only when ambient temperature is above 23 deg. F.
   a. While in hot gas defrost the system shall slow the indoor unit fan speed down to maintain a high discharge air temperature, systems that keep fan running in same state shall not be allowed as they provide an uncomfortable draft to the indoor zone due to lower discharge air temperatures.
   b. In reverse defrost all refrigerant shall be bypassed in the main branch controller and shall not be sent out to the indoor units, systems that flow refrigerant through indoor units during reverse defrost shall not be allowed.

J. Sound Performance: Sound levels generated by operating HVAC equipment shall be within requirements indicated.
   1. Indoor: Within design guidelines of "2019 ASHRAE HANDBOOK- HVAC Applications."
   2. Outdoor: Within ordinance of governing authorities.

K. Thermal Movements: Allow for controlled thermal movements from ambient, surface, and system temperature changes.

L. Capacities and Characteristics: As indicated on Drawings. Includes provisions for future additional equipment.

2.4 INDOOR, CONCEALED, CEILING-MOUNTED UNITS FOR DUCTING

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

B. Cabinet:
   1. Material: Galvanized or painted steel.
   2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
   3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.

4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:
1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:
1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material with threaded NPT.

E. Fan and Motor Assembly:
1. Fan(s):
   a. Direct-drive arrangement.
   b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
   c. Fabricated from non-ferrous components or ferrous components with corrosion-resistant finish.
   d. Wheels statically and dynamically balanced.
2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Three (low, medium, high), Auto or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:
1. Access: Bottom, side, or rear to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.
2. Filter Mixing Box: Rear or bottom placement with high-efficiency filters. Internally insulated with faced, glass-fiber duct liner, 20-gauge galvanized steel construction with gasketed access doors.
   a. Low static loss design,
   b. Knurled thumb screws on access door allow easy filter replacement,

c. Cabinet may be inverted to locate access from other side,
d. Foam gasket provides airtight connection to indoor unit and access door,
e. Gasket material complying with UL 723 requirements,
f. Screw-through cabinet design for secure attachment to indoor unit,
g. Return connection in rear easily field converted to bottom return,
h. Filter access door to include area to record maintenance schedule

3. Efficiency: ASHRAE 52.2, MERV 13.
4. Thickness: Minimum 2-inch.
5. Media: If more than one filter type is indicated, Contractor has option to choose.
   a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.

G. Unit Accessories:
1. Outdoor Air Ventilation Kit: Connection, motorized damper, and control sized to allow sequence of operation indicated on Drawings.
2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

H. Unit Controls:
1. Enclosure: Metal, suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:
   a. Unit inlet air temperature.
   b. Coil entering refrigerant temperature.
   c. Coil leaving refrigerant temperature.
4. Field-Customizable I/O Capability:
   a. Analog Inputs: Two for use in customizable control strategies.
   b. Digital Inputs: Two for use in customizable control strategies.
   c. Digital Outputs: Two for use in customizable control strategies.
5. Features and Functions:
   a. Self-diagnostics.
   b. Time delay.
   c. Auto-restart.
   d. External static pressure control.
   e. Auto operation mode.
   f. Manual operation mode.
   g. Filter service notification.
   h. Power consumption display.
   i. Drain assembly high water level safety shutdown and notification.
   j. Run test switch.
6. Communication: Network communication with other indoor and outdoor units.
7. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
8. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

I. Unit Electrical:
1. Enclosure: Metal, suitable for indoor locations.

2. Field Connection: Single point connection to power unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways.

2.5 INDOOR, RECESSED, CEILING-MOUNTED UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

B. Cabinet:
1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
5. Suitable for use in plenums in accordance with UL1995.
6.

C. DX Coil Assembly:
1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Internal Tubing: Copper tubing with brazed joints.
6. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:
1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material with threaded NPT.

E. Fan and Motor Assembly:
1. Fan(s):
a. Direct-drive arrangement.

b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:
1. Access: Bottom, to accommodate filter replacement without the need for tools.
2. Efficiency: ASHRAE 52.2, MERV 7
3. Media: If more than one filter type is indicated, Contractor has option to choose.
a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.

G. Discharge-Air Grille Assembly: Mounted in bottom of unit cabinet.
1. Discharge Pattern: One-, two-, three-, or four-way throw as indicated on Drawings.
a. Discharge Pattern Adjustment: Field-adjustable limits for up and down range of motion.
b. Discharge Pattern Closure: Ability to close individual discharges of units with multiple patterns.
2. Motorized Vanes: Modulating up and down flow pattern for uniform room air distribution. Auto-Wave selectable option in the heating mode that shall randomly cycle the vanes up and down to evenly heat the space.
3. Additional Branch Supply Duct Connection: Sheet metal knockout for optional connection to one additional supply branch duct.
4. The grille shall include a factory-installed “3D i-see” sensor, or equal, to work in conjunction with indoor unit control sequence to prevent unnecessary cooling or heating in unoccupied areas of the zone without decreasing comfort levels. Sensor must detect occupancy (not simply motion) and location of occupants by measuring size & temperature of objects within a 39 feet detecting diameter (based on 8.8 feet mounting height) with 1,856 or more measuring points.

H. Return-Air Grille Assembly: Manufacturer's standard grille mounted in bottom of unit cabinet.

I. Outdoor Air Ventilation Connection: Sheet metal knockout for optional connection to filtered outdoor air ventilation duct.

J. Unit Accessories:
1. Outdoor Air Ventilation Kit: Connection, motorized damper, and control to satisfy unit control sequence of operation indicated on Drawings.

2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
3. Multifunction casement with MERV 11 high efficiency filters.
4. Installation/Trim Panels: High performance ABS (Acrylonitrile Butadiene Styrene) plastic, a tough, light weight, impact resistant polymer in standard white color. Suitable to drop the panel into the tile space where the indoor unit will be installed. The panel frames the indoor unit with a smooth and uniform area that fits perfectly into the ceiling tile.
5. Additional accessories as scheduled on Drawings.

K. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors: Unit inlet air temperature or Coil leaving refrigerant temperature.
4. Field-Customizable I/O Capability:
   a. Analog Inputs: Two for use in customizable control strategies.
   b. Digital Inputs: Four for use in customizable control strategies.
   c. Digital Outputs: Three for use in customizable control strategies.
5. Features and Functions: Self-diagnostics, time delay, auto-restart, external static pressure control, auto operation mode, manual operation mode, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification, run test switch.
   a. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
   b. Include contacts for control of external heat source. External heat may be energized as second stage with 1.8 deg F – 9.0 deg F adjustable deadband from set point.
6. Communication: Network communication with other indoor units and outdoor unit(s).
7. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
8. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
9. Manufacturer shall provide drain pan level sensor powered by a 20-year life lithium battery. Sensor shall require no external power for operation and shall have an audible indication of low battery condition.
10. The drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur, the control shuts down the indoor unit before an overflow can occur. A thermistor error code shall be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

L. Unit Electrical:
1. Enclosure: Manufacturer's standard, and suitable for indoor locations.

2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

2.6 INDOOR, DEDICATED OUTDOOR AIR VENTILATION UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.
1. Specially designed for up to 100 percent outdoor air entering unit with the capability to reheat air using recovered energy from the primary cooling coil or provide a primary cooling coil only.
2. Split system type consists of central VRF (Variable Refrigerant Flow) outside unit connected via Branch Controller (or comparable branch device), and one ducted indoor unit.

B. Cabinet:
1. Material: Galvanized or painted steel.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly for Reheat Applications: Provide units with a reheat coil where indicated on Drawings.
1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material with threaded NPT.

E. Fan and Motor Assembly:
   1. Fan(s):
      a. Direct-drive arrangement.
      b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
      c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
      d. Wheels statically and dynamically balanced.
   2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
   3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
   4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
   5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:
   1. Access: Bottom, side, or rear to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.
   2. Efficiency: ASHRAE 52.2, MERV 13.
   3. Replaceable Media: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.
   4. Filter Frame: 20-gauge G-60 galvanized steel. Knurled thumb screws on access door allow filter replacement. Foam gasket provides air-tight connection to indoor unit and access door. Insulated to prevent condensation when outside air is 14 deg F or higher. Filter frame gasket(s) and insulation shall comply with U.L. Standard 94.

G. Unit Accessories:
   1. Motorized Inlet Damper Kit: Low-leakage damper with spring return electric actuator to fail closed on loss of power. Damper controlled by unit to open when unit is operating and close when unit off.

H. Unit Controls:
   1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
   2. Factory-Installed Controller: Configurable digital control. Wall-mountable controller to define set point control. Capable of scheduling and set point control via manufacturer centralized controllers or BACnet interfaces.
   3. Factory-Installed Sensors: Coil or unit entering refrigerant temperature, Coil or unit leaving refrigerant temperature, Unit entering-air relative humidity, and Unit leaving-air relative humidity.
   4. Field-Customizable I/O Capability:
      a. Analog Inputs: Two for use in customizable control strategies.

b. Digital Inputs: Two for use in customizable control strategies.
c. Digital Outputs: Two for use in customizable control strategies.

5. Features and Functions: Self-diagnostics, time delay, auto-restart, external static pressure control, auto operation mode, manual operation mode, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification, run test switch.
6. Communication: Network communication with other indoor units and outdoor unit(s).
7. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
8. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
9. Operation:
   a. The DOAS reheat system shall be rated at 87 deg F DB/80 deg F WB in cooling for both the outdoor unit and indoor unit entering air conditions. Heating rating point shall be 32 deg F DB/28 deg F WB for the outdoor unit and 32 deg F DB indoor unit entering air conditions.
   b. System operation parameters:
      1) The system shall operate with intake air temperature ranging from minus 4 deg F WB up to 95 deg F WB (109 deg F DB).
         a) The unit shall be capable of intake of unmixed or untreated minus 4 deg F WB air directly to the primary coil.
         b) The unit shall be capable of providing active coil operation in cooling mode down to 50 deg F WB.
      2) In a cooling condition, the system shall be capable of providing supply air for downstream use within the following specifications at rated conditions

	Minimum Leaving Air Condition		Maximum Leaving Air Condition	
Operation Type	Deg F, Dry Bulb	Deg F, Wet Bulb	Deg F, Dry Bulb	Deg F, Wet Bulb
Cooling Only, No Reheat	50	50	60	60
Cooling Mode with Reheat (Dehumidification)	63	51.5 (45% RH)	83	67.5 (45% RH)

1. Cooling Only, No reheat uses only primary cooling coil. Leaving air temperature can be chosen between 50 and 60 deg F in one-degree increments.
2. Cooling mode with reheat uses both primary cooling coil and reheat coil. Leaving air temperature from reheat coil can be chosen between 63 and 83 deg F in one deg F dry bulb increments along a line of 45 percent constant relative humidity.
3. Dehumidification (cooling) coil shall have adjustable settings to allow for target air temperature of 50, 55, or 60 deg. F DB or converted temperature from the leaving air temperature set point and relative humidity of 45% (45% RH Control)

      3) In heating mode, the system shall be capable of providing 78 deg F DB supply air at rated conditions.

I. Unit Electrical:
   1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.

2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

2.7 OUTDOOR, AIR-SOURCE HEAT RECOVERY UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s).
3. All units installed shall be from the same product development generation.
4. Outdoor unit shall have a sound rating no higher than 68 dB(A) individually or 70 dB(A) twinned. Units shall have a sound rating no higher than 52 dB(A) individually or 55 dB(A) twinned while in night mode operation. Units shall have 5 levels sound adjustment via dip switch selectable fan speed settings.

B. Cabinet:
1. Galvanized steel and coated with a corrosion-resistant finish.
a. Coating with documented salt spray test performance of 960 hours according ASTM B 117 surface scratch test (SST) procedure.
2. Mounting: Manufacturer-designed provisions for field installation.
a. Four-legged outdoor unit mounting systems shall be provided by manufacturer. Stand shall be made from minimum 7-gauge plate steel with thermally fused polyester powder coat finish that meets ASTM D3451 standards. Stands shall be provided with galvanized mounting hardware and meets all ASCE 7 overturning safety requirement.
3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Compressor and Motor Assembly:
1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown to 15 percent of rated capacity. Non inverter-driven compressors shall not be allowed. Equip each compressor with a multi-port discharge mechanism to eliminate over compression at part load. Manufacturer’s that rely on a single compressor discharge port and provide no means of eliminating over compression and energy waste at part load shall not be allowed.

2. Protection: Integral protection against the following:
   a. High refrigerant pressure.
   b. Low oil level.
   c. High oil temperature.
   d. Thermal and overload.
   e. Voltage fluctuations.
   f. Phase failure and phase reversal.
   g. Short cycling.
   h. DC bus protection.
   i. Prewired plugs for optional panel heaters in order to prevent any residual ice buildup from defrost. Include panel heaters for operating environments where the ambient temperature is expected to stay below minus 1 deg F for 72 hours..
3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
4. Vibration Control: Integral isolation to dampen vibration transmission.
5. Oil management system to ensure safe and proper lubrication over entire operating range. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained. Oil return sequences must be enabled only during extended periods of reduced refrigerant flow to ensure no disruption to correct refrigerant flow to individual zones during peak loads. Systems which might engage oil return sequence based on hours of operation risk oil return during inopportune periods are not allowed. Systems which rely on sensors (which may fail) to engage oil return sequence are not allowed.
6. Crankcase heaters with integral control to maintain safe operating temperature. Crankcase heat shall be provided via induction-type heater utilizing eddy currents from motor windings. Energy-wasting “belly-band” type crankcase heaters are not allowed. Manufacturers that utilize belly-band crankcase heaters will be considered as alternate only.
7. Fusible plug.
8. Accumulator with refrigerant level sensors and controls. Units shall actively control liquid level in the accumulator via Linear Expansion Valves (LEV) from the heat exchanger.

D. Condenser Coil Assembly:
   1. Plate Fin Coils:
      a. Casing: Aluminum, galvanized, or stainless steel.
      b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
      c. Tubes: Copper, of diameter and thickness required by performance.
   2. Aluminum Microchannel Coils:
      a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
      b. Single- or multiple-pass arrangement.
      c. Construct fins, tubes, and header manifolds of aluminum alloy.

3. Hail Protection: Provide condenser coils with louvers, baffles, or minimum 20 gauge hot-dipped galvanized steel hoods to protect against hail damage and snow build-up in severe climates.
4. Coil shall be protected with an internal metal guard.
5. Outdoor Coil shall be elevated at least 12 inches from the base on the unit to protect coil from freezing and snow build up in cold climates. Manufacturer's in which their coil extends to within a few inches from the bottom of their cabinet frame shall provide an additional 12 inches of height to their stand or support structure to provide equal protection from elements.
6. Condenser coil shall have active hot gas circuit direct from compressor discharge on lowest coil face area to shed defrost condensate away from coil and protect from Ice formation after returning to standard heat pump operation. While in Heat Pump operation this lower section of the Outdoor Evaporator coil shall continually run hot gas from the compressor discharge to protect the coil from ice buildup and coil rupture. Manufacturers who do not have an active hot gas circuit in the lower section of the Outdoor coil to protect coil from freezing shall not be allowed to bid on project in markets where the outdoor unit will see temperatures below freezing.

E. Condenser Fan and Motor Assembly:
1. Fan(s): Propeller type.
   a. Direct-drive arrangement.
   b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
   c. Statically and dynamically balanced.
2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Variable speed with a speed range of least 75 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

G. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:
   a. Refrigerant suction temperature.
   b. Refrigerant discharge temperature.
   c. Outdoor air temperature.
   d. Refrigerant high pressure.

e. Refrigerant low pressure.
f. Oil level.

4. Features and Functions: Self-diagnostics, time delay, auto-restart, fuse protection, auto operation mode, manual operation mode, night setback control, power consumption display, run test switch equalize run time between multiple same components.
   a. Outdoor unit shall include Variable Evaporator Temperature or comparable method of varying system evaporator (refrigerant) temperature in order to reduce compression ratio and power consumption during light load or mild ambient temperatures. Multiple evaporator refrigerant temperature settings shall be required in order to optimize efficiency within required system-specific performance and installation constraints. System shall reduce compression ratio only when/if all indoor units are within 1.8 deg F of setpoint; reducing compression ratio based solely on ambient temperature risks discomfort and is not allowed. Variable Evaporator Temperature or comparable method shall incorporate override or disable capability based on external signal to allow for space humidity control or load demand. The unit shall be an integral part of the system & control network specified and react to heating/cooling demand as communicated from connected indoor units over the control circuit. Required field-installed control voltage transformers and/or signal boosters shall be provided by the manufacturer.
   b. Capable of 4 levels of demand control based on external input.
5. Communication: Network communication with indoor units and other outdoor unit(s).
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

H. Unit Electrical:
1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

I. Unit Hardware: Zinc-plated steel, or stainless steel.

J. Unit Piping:
1. Unit Tubing: Copper tubing with brazed joints.

2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.8 HEAT RECOVERY CONTROL UNITS (HRCUs / BCUs)

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple units that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices which do not include controlled refrigerant subcooling risk bubbles in liquid supplied to indoor unit LEVs and are not allowed.

B. Cabinet:
1. Galvanized-steel construction.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
5. Suitable for use in plenums in accordance with UL1995.

C. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection. Cabinets filled with solid foam insulation do not allow for future service and are not allowed.

D. Refrigeration Assemblies and Specialties:
1. Specially designed by manufacturer for type of VRF HVAC system being installed, either two or three pipes.
2. Each refrigerant branch circuit shall have refrigerant control valve(s) to control refrigerant flow.
3. Spares: Each heat recovery control unit shall include at least two branch circuit port(s) for future use.
4. Each system piping connection upstream of heat recovery unit shall be fitted with an isolation valve to allow for service to any heat recovery control unit in the system without interrupting operation of the system.
5. Each branch circuit connection shall be fitted with an isolation valve and capped service port to allow for service to any individual branch circuit without interrupting operation of the system.
a. If not available as an integral part of the heat recovery control unit, isolation valves shall be field installed adjacent to the unit pipe connection.

E. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Features and Functions: Self-diagnostics, fuse protection.
4. Communication: Network communication with indoor units and outdoor unit(s).
5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

F. Unit Electrical:
1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

G. Unit Piping:
1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.9 SYSTEM CONTROLS

A. General Requirements:
1. Network: Indoor units, HRCUs, and outdoor units shall include integral controls and connect through a TIA-485A or manufacturer-selected control network.
2. Network Communication Protocol: open control communication between interconnected units.
3. Integration with Building Automation System: ASHRAE 135, BACnet IP and certified by BACnet Testing Lab (BTL), including the following:
a. Ethernet connection via RJ-45 connectors and port with transmission at minimum 100 Mbps or higher.
b. Integration devices shall be connected to local uninterruptible power supply unit(s) to provide at least 15 minutes of battery backup operation after a power loss.
c. Integration shall include control, monitoring, scheduling, and change of value notifications.
4. Operator Interface:

a. Operators shall interface with system and unit controls through the following:
   1) Operator interfaces integral to controllers.
   2) Owner-furnished PC connected to central controller(s).
   3) Web interface through web browser software.
   4) Integration with Building Automation System.

b. Users shall be capable of interface with controllers for indoor units control to extent privileges are enabled. Control features available to users shall include the following:
   1) On/off control
   2) Temperature set-point adjustment
   3) Optimal start
   4) Request-based logic
   5) Demand level adjustment of overall system capacity.

B. VRF HVAC System Operator Software for PC:
   1. Software offered by VRF HVAC system manufacturer shall provide system operators with ability to monitor and control VRF HVAC system(s) from a single dedicated Owner-furnished PC.
   2. Software shall provide operator with a graphic user interface to allow monitoring and control of multiple central controllers from a single device location through point-and-click mouse exchange.
   3. Plan views shall show building plans with location of indoor units and identification superimposed on plans.
   4. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
   5. Schedules operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Schedules daily, weekly, and annual events.
   6. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
   7. Optimized start features to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
   8. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
   9. Supports Multiple Languages: English or Spanish.
   10. Supports Imperial and Metric Temperature Units: Fahrenheit.
   11. Displays service notifications and error codes.
   12. Monitors and displays up to 3000 item error history and 10000 item operation history for regular reporting and further archiving.
   13. Monitors and displays cumulative operating time of indoor units.
   14. Able to disable and enable operation of individual controllers for indoor units.
   15. Information displayed on individual controllers shall also be available for display.
   16. Information displayed for outdoor units, including refrigerant high and low pressures percent capacity.

C. Central Controllers:

1. Centralized control for all indoor and outdoor units from a single central controller location.
    a. Include multiple interconnected controllers as required.
2. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
3. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
    a. Sets schedule for daily, weekly, and annual events.
    b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.
4. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
5. Optimized start features to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
6. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
7. Service diagnostics tool.
8. Able to disable and enable operation of individual controllers for indoor units.
9. Information displayed on individual controllers shall also be available for display through central controller.
10. Information displayed for outdoor units, including refrigerant high and low pressures percent capacity.
11. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
12. Operator interface through a backlit, high-resolution color display touch panel and web accessible through standard web browser software.
13. Displays:
    a. Compressor speed and hi/low pressure
    b. Advanced HVAC Controller (DC-A2IO) input/output status
    c. Indoor unit free contact input/output status
    d. Space Temperature and Humidity (from Smart ME or AI controller)
    e. Error code
    f. Unoccupied setback up temperature range
14. Functions
    a. Hold function (temporarily disables schedules indoor unit model dependent)
    b. Initial setting
    c. Operation data back-up
15. Permits or prohibits remote controller functions:
    a. On/Off
    b. Change Operation Mode
    c. Change Set point Temperature
    d. Filter Status
    e. Change Fan Speed
    f. Change Air Direction
16. External input/output signals can be used for batch operations such as Start/Stop and Emergency Stop (Provide PAC-YG10HA).

17. Temperature set point range limits can be set for local remote controllers
18. User defined indoor unit functions:
    a. On/Off
    b. Monitoring and Operation
    c. Operation mode:
        1) Auto* (Dual or Single set point)
        2) Cool
        3) Heat
        4) Fan
        5) Drying
        6) Setback*
        7) Note: *R2 Series only (connected equipment dependent)
    d. Temperature Setting
    e. Fan Speed
    f. Airflow Direction
19. Monitoring and Control:
    a. CITY MULTI® indoor units
    b. M & P Series units (Requires M-Net adapter)
    c. Lossnay units
    d. PWFY hydronic heat pump units
    e. DIDO controllers
    f. CITY MULTI® DOAS
    g. Interlock setting enables integration of general equipment inputs/outputs and indoor units
20. Scheduling
    a. Daily
    b. Annually
    c. Five pattern weekly seasonal schedule
21. Twenty-four scheduled events per day, indoor unit model dependent:
    a. ON/OFF
    b. Mode
    c. Temperature Setting
    d. Vane Direction
    e. Fan
    f. Speed
    g. Operation Prohibits
22. Trend data:
    a. Fan operation time
    b. Thermo-on time
    c. Set temperature
    d. Room temperature
    e. AI Controller temperature and humidity (Provide PAC-YG63 MCA, 2 inputs total for each controller)
23. Memory back up via USB (universal serial bus) port
24. Standard software functions shall be available so that the building manager can securely log into each Central Controller via the PC's web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics. Additional software functions of personal browser for PCs and MACs shall be included. Include TG-2000 Integrated System software.

D. Web-based User Interface
   1. All PCs shall be provided field supplied by Owner.
   2. Include the following software functions:
      a. PC-Monitoring (SW-Mon): The CMCN shall be capable of monitoring and operating all indoor units from a networked PC's web browser for up to 50 units per AE-200/AE-50/EB-50GU and up to 24 units per GB-24 Central controller.
      b. PC Scheduling (SW-Sch): The CMCN shall be capable of creating customized daily, weekly, and annual schedules from a network PC's web browser for up to 50 units per AE-200/AE-50/EB-50GU and up to 24 units per GB-24. Schedules shall be applied to a single indoor unit, a group of indoor units, or collectively (batch) to all indoor units controlled by the AE-200/AE-50/EB-50GU.
      c. Online Error Email (SW-Email): The CMCN shall be capable of sending detailed alerts to customizable distribution lists based on user defined error types.
      d. Online Maintenance Diagnostics (SW-Maint): The CMCN shall be capable of performing maintenance diagnostics via a network PC and AE-200/AE-50/EB-50GU Central controller using Maintenance Tool Software.
      e. Interlock Function (SW-Interlock): Allows configuration and control of free inputs/outputs on the indoor units.
      f. Personal Web Browser (SW-Pweb): The CMCN shall be capable of allowing up to 50 individual users to monitor and control user defined zones via a network PC or MAC's web browser.

E. Graphical User Workstation Software
   1. The Graphical User Interface (Integrated Centralized Control Web) shall be installed on BAS OWS.
   2. The Integrated Centralized Control Web System (ICCW) interface shall enable the user to control multiple networked central controllers and shall provide additional functions such as energy apportionment from a single network PC configured with the Charge Calculation Tool. The ICCW shall be capable of controlling up to forty networked Centralized Controllers with a maximum of 2,000 indoor units across multiple CITY MULTI outdoor units. The ICCW shall be required if the user wants to simultaneously control more than 1 Centralized Controllers from a single PC or tablet using a single web browser session. Licensing per function, per Centralized Controller shall be required for the ICCW. Optional software features shall be available through the ICCW including energy apportionment and personalized web. These optional software features shall require the ICCW, advance purchase from the customer, and licensing from ICCW.
      a. ON/OFF: The units can turn ON and OFF for all floors or in a block, floor, or group of units.
      b. Operation Modes: The operation mode can be switched between COOL, DRY, FAN, AUTO, and HEAT for all floors or in a block, floor, or group of units
      c. Temperature Setting:

1) Sets the temperature for a single group. Range of Temperature setting from 57 deg F – 87 deg F depending on operation mode and indoor unit model.
2) Separate COOL and HEAT mode set points available depending on remote controller and connected mechanical equipment.

d. Fan Speed: The fan speed can be set to four stages for all floors or in a block, floor, or group of units
e. Air Direction: The air direction can be set in four vertical directions or to swing for all floors or in block, floor, or group of units. (The selectable air direction differs according to the model.)
f. Interlocked Unit ON/OFF ERV: If there is an interlocked energy recovery ventilator (LOSSNAY), then the unit can be turned ON (strong/weak) or OFF for all floors or in a block, floor, or group of units. (Note that the ventilation mode cannot be selected for interlocked units.)
g. Local Operation Prohibit: The items for which operation with the local remote controller are to be prohibited can be selected for all floors or in a block, floor, or group of units. (The items that can be prohibited are ON/OFF, operation mode, set temperature and filter sign reset.)
h. Annual / Weekly Schedule: The annual/weekly schedule function can be used by registering the license. Two settings, such as seasonal settings for summer and winter, can be saved.
i. Power Rate Apportionment Charging: A watt-hour meter (WHM) with kWH pulse output is connected to calculate the air conditioning charges based on the amount each tenant's air-conditioner has operated. Five charging rates can be applied per day. Include energy apportionment software (LIC-CHARGE) and PI Controller (PAC-Y60MCA).
j. History: Up to 3,000 items for the error history and up to 10,000 items for operation history can be saved. Each history file can be output as a daily report or monthly report in CSV format. (The operation history consists only of the operations carried out with the ICCW and is limited to some limited operation items.)
k. Operation Time Monitor: The cumulative operation time of each indoor unit can be viewed or output as a CSV format file. (This function is valid only when the charging function license is registered.)
l. Filter Sign Display Mask: The filter sign display at the remote controllers can be disabled.

F. Wired Controllers for Indoor Units:
1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. Multiple Language: English or Spanish.
4. Temperature Units: Fahrenheit.
5. On/Off: Turns indoor unit on or off.
6. Hold: Hold operation settings until hold is released.
7. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
8. Temperature Display: 1-degree increments.
9. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments between 40 and 95.
10. Relative Humidity Display: 1 percent increments.

11. Relative Humidity Set-Point: Adjustable in 1 percent increments between 30 and 60 percent.
12. Fan Speed Setting: Select between available options furnished with the unit.
13. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
14. Seven-day programmable operating schedule with up to eight events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
15. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
16. Occupancy detection with adjustable sensitivity.
17. Brightness Sensor:Detects brightness in the space and indicates brightness on the remote controller and through the web browser interface depending on connected equipment. Sensitivity is adjustable.
18. Status Monitor: Displays the status of general equipment control points connected to the Advanced HVAC Controller (DC-A2IO).
19. Humidity Setting: Sets the relative humidity set point in 1% increments for any humidifier connected to the Advanced HVAC Controller (DC-A2IO)
20. Energy-Save control during vacancy : When vacancy is detected by the occupancy sensor 5 control options are available for selection:
    a. Stop/Setback Mode/Set Temperature Offset/Low Fan Speed/Thermo-off.
    b. Brightness sensor can be used in conjunction with the occupancy sensor to increase accuracy.
21. Permit / Prohibit Local Operation: Individually prohibit operation of each local remote-control function (Start/Stop, Change operation mode, Set temperature, Fan Speed, Air Direction, Reset filter). Operation icon shall light up on the remote controller for prohibited functions.
22. Operation Lock Out Function: Locking of ON/OFF, Mode, Set Temp, Hold button and Air Direction.
23. Hold: Prohibit the scheduled operation from being executed
    a. ON/OFF timer
    b. Auto-OFF timer
    c. Weekly timer
    d. Automatic return to the preset temperature
    e. While an operation is prohibited by Hold function, the operation icon shall light up.
24. Service Notification Display: "Filter" “Drain Overflow”.
25. Service Run Tests: Limit use by service personnel to troubleshoot operation.
26. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
27. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
28. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
29. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.

G. Input/output (I/O) Boards
    1. Advanced HVAC Controller (AHC)

a. The AHC shall be capable of providing programmable binary and analog inputs and outputs to control general equipment in conjunction with indoor unit functions and states. Input and output states and values shall be monitored through the EB-50GU or the Smart ME Remote controller. The Smart ME remote controller shall be able to adjust temperature and humidity set points for equipment controlled by the AHC. In addition to analog and binary inputs the AHC can monitor M-NET equipment states and sensor values. Available inputs include room temperature, room humidity, occupancy, brightness, outdoor temperature, inlet/outlet water temperature (PWFY), on/off state, mode, ventilation on/off, error status. In addition to programmable analog and binary outputs, the AHC can control indoor unit on/off, mode, temperature set point, fan speed, LOSSNAY on/off and LOSSNAY fan speed.

2. Digital Input Digital Output (DIDO) Board
   a. The DIDO board shall be capable of providing On/Off control for non-Mitsubishi equipment via the AE-200/AE-50/EB-50GU Central Controller's licensed web browser functions, the touch screen of the AE-200, AE-50, and TC-24 Central Controller, the interlock function of the AE-200/AE-50/EB-50GU and the TG-2000 software. Each DIDO board shall have two digital inputs and two digital outputs. Each digital output shall be capable of supporting an independent schedule via the AE-200/AE-50/EB-50GU Central Controller's licensed web browser functions and the TG-2000 software. Status indication of the On/Off state of the non-Mitsubishi equipment shall be either via the On/Off status of the digital output or by receipt of a digital input to the DIDO board.
   b. The DIDO board shall be capable of receiving a digital input for interlock settings with the CITY MULTI indoor units or digital outputs on the DIDO board. Based on the digital input status the DIDO board shall be capable of setting the following parameter on the indoor unit On/Off, Mode, and Set Temperature to predefined settings. The DIDO board shall also be capable of interlocking the On/Off state of a digital output on the DIDO board based on an onboard channel digital input status or a free contact input status from system indoor units.
3. Analog Input (AI) Board
   a. Capable of monitoring temperature or humidity via Central Controller's licensed web browser functions and the TG-2000 software. Each AI board shall have two analog inputs. Each input shall be capable of receiving a 4-20mA, 0-10 VDC, or 1-5 VDC signal for monitoring temperature or humidity. Capable of monitoring the temperature or humidity input and shall be capable of displaying graphical trending of the temperature or humidity values via the Central Controller's licensed web browser functions and the TG-2000 software. Notification of user adjustable high- and low-level alarms shall be capable of being emailed to distribution list or outputted via a digital output.
   b. Capable of setting the following parameters on the indoor unit On/Off, Mode, and Set Temperature to predefined settings based on the input value of the temperature or humidity. Capable of interlocking the On/Off state of a digital output on the input value of the temperature or humidity.

H. System Integration

1. The communication control network shall be capable of supporting integration with Building Management Systems (BMS).
2. BACnet® Integration
   a. BACnet® interface, BAC-HD150, shall be compliant with BACnet® Protocol (ANSI/ASHRAE 135) and be Certified by the (BTL) BACnet® Testing Laboratories. The BACnet® interface shall support BACnet Broadcast Management (BBMD). The BACnet® interface shall support a maximum of 50 indoor units. Operation and monitoring points include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, and error address.
   b. BACnet Point List / Object List

• On Off Setup
• On Off State, Number of ON/OFF, Cumulative operation time
• Alarm Signal (4-digit error code)
• Error Code
• Operational Mode Setup
• Operational Mode State
• Fan Speed Setup
• Fan Speed State
• Room Temp
• Set Temp
• Set Temp Cool
• Set Temp Heat
• Set Temp Auto
• Filter Sign
• Filter Sign Reset
• Prohibition On Off
• Prohibition Mode
• Prohibition Filter Sign Reset
• Prohibition Set Temperature
• M-NET Communication State
• System Forced Off
• Air Direction Setup
• Air Direction State
• Set High Limit Setback Temp
• Set Low Limit Setback Temp
• Ventilation Mode Setup
• Ventilation Mode State
• Air To Water Mode Setup
• System Alarm Signal (4-digit error code)
• PI Controller Alarm Signal (4-digit error code)
• Group Apportioned Electric Energy

• Interlocked Units Apportioned Electric Energy
• PI controller Electric Energy 1–4
• Pulse Input Electric Energy 1–4
• Group Apportionment Parameter
• Interlocked Units Apportionment Parameter
• Night Purge State
• Thermo On Off State
• Trend Log Room Temp
• Trend Log Group Apportioned Electric Energy
• Trend Log Interlocked Units Apportioned Electric Energy
• Trend Log PI controller Electric Energy 1–4
• Trend Log Pulse Input Electric Energy 1–4
• Trend Log Group Apportionment Parameter
• Trend Log Interlocked Units Apportionment Parameter

I. Power Supply (PAC-SC51KUA)
1. The power supply shall supply 24VDC (TB 3) for the centralized controller and 24VDC (TB 2) voltage for the central control transmission.

J. Maintenance Tool Software and MN-Converter (CMS-MNG-E)
1. The Maintenance Tool, via the MN-Converter (CMS-MNG-E), shall enable the user to monitor and record the following parameters in a centralized system.
   a. Outdoor Unit
      1) Operation Mode (Cooling Only, Heating Only, Cooling Main, Heating Main)
      2) Compressor Frequency, amperages, and voltages
      3) Compressor high- and low-side pressure
      4) System Temperatures
      5) Outdoor temperature
      6) Status of reversing valve
   b. BC Controller
      1) Valve ON/OFF status
      2) Temperatures
      3) Pressures
   c. Indoor Unit
      1) Entering Air Temperature
      2) Entering/Leaving Refrigerant Temperature
      3) Superheat/Subcool temperatures
      4) LEV position
      5) Room temperature setpoint
      6) Unit Mode and Status (Heat, Cool, Dry, Auto, Fan)
2. The Maintenance Tool shall have the additional feature of controlling the following system components manually:

a. Indoor Unit
   1) Indoor Unit ON/OFF
   2) Mode (Heat, Cool, Dry, Auto, Fan)
   3) Room Temperature Setpoint
   4) Fan speed
   5) LEV Position
b. BC Controller
   1) Valve OPEN/CLOSE
   2) LEV Position

3. The Maintenance Tool shall be connectable to either the TB3 or TB7 communication bus lines on the MNET via alligator connectors.
4. The Maintenance Tool shall be connectable to a PC via a USB cable.
5. Trended data from Maintenance Tool shall be available to export to a data file for offline analysis.

2.10 FACILITY MANAGEMENT AND CONTROL SYSTEM (FMCS)

A. The Facility Management and Control System (FMCS) shall be comprised of System Network Controller or Controllers (SNC) within each facility. The SNC shall connect to the owner's local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Each SNC shall communicate to Mitsubishi Electric Central Controllers, LonMark/LonTalk (IDC) and/or BACnet (IBC) controllers, and other open and legacy protocol systems/devices provided under Division 23.

B. The Facility Management and Control System (FMCS) as provided in this Division shall be based on the Niagara Framework (or "Niagara"), a Java-based framework developed by Tridium. Niagara provides an open automation infrastructure that integrates diverse systems and devices (regardless of manufacturer, communication standard or software) into a unified platform that can be easily managed in real time over the Internet using a standard Web browser. Systems not developed on the Niagara Framework platform are unacceptable.

C. Scope: Furnish all labor, materials and equipment necessary for a complete and operating Building Management System (BMS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only. All controllers furnished in this section shall communicate with the Mitsubishi Electric Diamond Controller.

D. System architecture shall fully support a multi-vendor environment and be able to integrate third party systems via existing vendor protocols including, as a minimum, LonTalk, BACnet, and Modbus.

E. System architecture shall provide secure Web access using MS Internet Explorer from any computer on the owner's LAN.

F. Any control vendor that must provide additional BMS server software shall be unacceptable. Only systems that utilize the Niagara AX™ Framework shall satisfy the requirements of this section.

G. The BMS server shall host all graphic files for the control system.

H. DC-8000 Controller
1. General information: Compact embedded IoT controller and server platform for connecting multiple and diverse devices and sub-systems. With internet connectivity and Web-serving capability, the DC-8000 controller provides integrated control, supervision, data logging, alarming, scheduling, and network management. It streams data and rich graphical displays to a standard Web browser via an Ethernet or wireless LAN, or remotely over the internet.
2. Application: Ideal for smaller facilities, remote sites, and for distributing control and monitoring throughout large facilities. Optional I/O modules can be plugged in for applications where local control is required. Supports a wide range of field busses for connection to remote I/O and stand-alone controllers. In small facility applications and all you need for a complete system. Manage global control functions, support data passing over multiple networks, connect to enterprise level software applications, and host multiple, simultaneous client workstations connected over the local network, the Internet, or dial-up modem. In larger facilities, multi-building applications and large-scale control systems integrations, Niagara 4 Supervisors can be used with JACE 8000 controllers to aggregate information, including real-time data, history, and alarms, to create a single, unified application.
3. Specifications
   a. Base Unit:
      1) Two Isolated RS 485 Ports
      2) Two 10/100MB Ethernet Ports
      3) USB Backup & Restore
      4) Wireless Connectivity
      5) Compatible with DC-600E modules
      6) Runs Niagara 4.1 and later
   b. Batteryless operation
      1) Expandable with up to four option modules
      2) Real time Clock
   c. Platform
      1) Texas Instruments® AM3352 1000Mhz ARM® Cortex™-A8
      2) 1 GB DDR3 SDRAM
      3) USB backup and restore
   d. Communications
      1) 2 Ethernet Ports: 10/100MB
      2) 2 Isolated RS-485 Port
      3) Supports IEEE 802.11a/b/g/n networks
      4) Configurable radio (Off, WAP, or Client)
      5) Mobile phone and Tablet Accessible
      6) LON FTT10 & RS232 expansion
      7) Antenna with SMA Connector
      8) Support WPA-PSK, WPA2-PSK security protocols

9) Secure boot
e. Memory upgrade Option
f. Operating System
1) Niagara 4.1 and later
g. Chassis
1) Construction: Plastic, din rail or screw mount chassis, plastic cover
2) Compatible with DIN 43880 enclosures
3) Cooling: Internal air convection
h. Temperature Ratings
1) Operational Temperature: -4 to 140 deg F (-20 to 60 deg C)
2) Storage Temperature Range: -40 to 185°F (-40 to 85 deg C)
i. Humidity Rating: 5 to 95 percent RH. Non-condensing
j. Rating Approvals:
1) ROHS
2) UL 916
3) CE EN 61326-1
4) FCC Part 15 Subpart B, Class B
5) FCC Part 15 Subpart C
6) CCC
7) SRRC
8) RSS

l. Diamond Controller Server
1. Flexible network server for all connected DC-8000 controllers. The Diamond Controller Server designed to harness the power of the Internet and provide efficient integration of standard open protocols, such as BACnet™, oBIX, Modbus, and LONWORKS®. The Server to create a powerful network environment with comprehensive database management, alarm management and messaging services. The Server to provide an engineering environment and graphical user interface to support the design, configuration, installation and maintenance of interoperable networks. Include oBIX in the Server package as a means of integrating Niagara-based Release 2 (R2) controllers. With release 2.3.522 or greater, the oBIX driver can be added to expose all data points, schedules, trends and alarms to a Niagara AX or Niagara 4 system. oBIX driver shall be both a client and server.
2. Powerful HTML5 and Java enabled graphical user interface (UI) as well as a non-Java UI for browsers. JavaScript data interface library included (Bajascript).
3. Support an unlimited number of users over the Internet / intranet with a standard Web browser depending on the host PC resources.
4. Enhanced certification management includes tools to manage 3rd party & self-signed certificates.
5. Enterprise level data archival using an SQL, Oracle or DB2 database and HTTP/ HTML/XML text formats.
6. Audit trail:
a. Database changes
b. Database storage and backup
c. Global time functions
d. Calendar
e. Central scheduling

f. Control
g. Energy management routines
h. User actions
i. Security related events

7. Sophisticated alarm processing and routing which includes email and paging.
8. Niagara 4's use of HTML5 provides a user interface that makes it easier for system integrators to create and maintain customized views for end users.
9. Provide access to alarms, logs, graphics, schedules and configuration data with a standard Web browser.
10. Follow industry best practices for cyber security, with support for features such as strong hashed passwords. TLSv1 for secure communications and certificate management tools for authentication.
11. Graphics library shall be updated with 3-D and photo realistic images for generic graphics & HVAC equipment.
12. Drag and drop customizable charting for fast information visualization.
13. Uses Role-Based Access Control (RBAC), making user permissions easy to configure and less error prone.
14. Backwards compatible with Niagara AX-requires Niagara AX v3.6u4, v3.7u1, v3.8R
15. Niagara AX to Niagara 4 station migration tool.
16. Compatibility Summary:
    a. Fox network compatibility between Niagara AX and Niagara 4
    b. Station conversion tool to convert Niagara AX stations to Niagara 4 stations (.bog files)
    c. Public APIs
    d. Niagara Driver Framework still supported
    e. Niagara 4 will run on any JACE with HotSpot VM (J3, J6, J6E, J7) and on any JACE 8000 controller
17. Platform Requirements
    a. Processor: Intel® Xeon® CPU E5-2640 x64 (or better), compatible with dual- and quad-core processors
    b. Operating System:
        1) Windows 10, 64-bit Windows 8.1 Enterprise, 2012 R2 Standard, RHEL-7
        2) Windows server 2012 Enterprise SP2 64 bit
        3) Supports standard internet browser viewing
    c. HTML based help system that includes comprehensive online system documentation.
    d. GB Network Card
    e. Supports multiple Niagara-based stations connected to a local Ethernet network, or the Internet.
    f. Provides online/offline use of the Niagara Framework® Workbench AX graphical application configuration tool and a comprehensive Java Object Library.
    g. Microsoft SQL2014
    h. Direct Ethernet based driver support for most Open IP field bus protocols

J. Software Ownership: The Owner shall have full ownership and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BMS.

2.11 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:
1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
2. ASHRAE 34, Class A1 refrigerant classification.
3. R-410a.

B. Oil:
1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.12 SYSTEM CONDENSATE DRAIN PIPING

A. If more than one material is listed, material selection is Contractor's option.

B. Copper Tubing:
1. Drawn-Temper Tubing: According to ASTM B 88, Type L or Type DWV according to ASTM B 306.
2. Wrought-Copper Fittings: ASME B16.22.
3. Wrought-Copper Unions: ASME B16.22.
4. Solder Filler Metals: ASTM B 32, lead-free alloys, and water-flushable flux according to ASTM B 813.

2.13 SYSTEM REFRIGERANT PIPING

A. Comply with requirements in Section 232300 "Refrigerant Piping" for system piping requirements.

B. Refrigerant Tubing Kits:
1. Furnished by VRF HVAC system manufacturer.
2. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
3. Standard one-piece length for connecting to indoor units.
4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation. Comply with requirements in Section 230719 “HVAC Piping Insulation.”
5. Factory Charge: Dehydrated air or nitrogen.

C. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.

D. Refrigerant Isolation Ball Valves:

1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
3. Valve Connections: Flare or sweat depending on size.

2.14 METAL HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 “Hangers and Supports for HVAC Piping and Equipment" for hangers and supports requirements.

B. Copper Tube Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or copper-coated steel.

2.15 METAL FRAMING SYSTEMS

A. Comply with requirements in Section 230529 “Hangers and Supports for HVAC Piping and Equipment" for hangers and supports requirements.

B. MFMA Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. B-line, an Eaton business.
   b. Flex-Strut Inc.
   c. G-Strut.
   d. Haydon Corporation.
   e. MIRO Industries, Inc.
   f. Thomas & Betts Corporation; A Member of the ABB Group.
   g. Unistrut; Part of Atkore International.
   h. Wesanco, Inc.
2. Description: Shop- or field-fabricated, pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel for use indoors and of stainless steel for use outdoors.
7. Metallic Coating for Use Indoors: hot-dip galvanized or mill galvanized.
8. Plastic Coating for Use Outdoors: polyurethane, epoxy or polyester.

2.16 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded, zinc-coated steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Indoor Applications: Zinc-coated steel.
   2. Outdoor Applications: Stainless steel.

2.17 PIPE STANDS

A. Comply with requirements in Section 230529 “Hangers and Supports for HVAC Piping and Equipment" for hangers and supports requirements.

B. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

C. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

D. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

E. High-Type, Single-Pipe Stand:
   1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
   2. Base: Stainless steel.
   3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
   4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

F. High-Type, Multiple-Pipe Stand:
   1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
   2. Bases: One or more; plastic.
   3. Vertical Members: Two or more protective-coated-steel channels.
   4. Horizontal Member: Protective-coated-steel channel.
   5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

G. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.18 MISCELLANEOUS SUPPORT MATERIALS

A. Comply with requirements in Section 230529 “Hangers and Supports for HVAC Piping and Equipment" for hangers and supports requirements.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; galvanized.

D. Threaded Rods: Continuously threaded. Zinc-plated steel or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar material as rods.

2.19 PIPING AND TUBING INSULATION

A. Comply with requirements in Section 23 0719 "HVAC Piping Insulation" for system piping insulation requirements.

2.20 SYSTEM CONTROL CABLE

A. Cable Rating: Listed and labeled for application according to NFPA 70.
   1. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
      a. Flame Travel Distance: 60 inches or less.
      b. Peak Optical Smoke Density: 0.5 or less.
      c. Average Optical Smoke Density: 0.15 or less.
   2. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
   3. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

B. Low-Voltage Control Cabling:
   1. Paired Cable: NFPA 70, Type CMG.
      a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
      b. PVC insulation.
      c. Braided or foil shielded.
      d. PVC jacket.
      e. Flame Resistance: Comply with UL 1685.
   2. Lead Content: Less than 300 parts per million.
   3. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
b. PVC insulation.
c. Braided or foil shielded.
d. PVC jacket.
e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
f. Flame Resistance: Comply with NFPA 262.

4. Lead Content: Less than 300 parts per million.

C. TIA-485A Network Cabling:
1. Standard Cable: NFPA 70, Type CMG.
a. Paired, one pair or two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
b. PVC insulation.
c. Unshielded.
d. PVC jacket.
e. Flame Resistance: Comply with UL 1685.
2. Lead Content: Less than 300 parts per million.
3. Plenum-Rated Cable: NFPA 70, Type CMP.
a. Paired, one pair or two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
b. Fluorinated ethylene propylene insulation.
c. Unshielded.
d. Fluorinated ethylene propylene jacket.
e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
f. Flame Resistance: NFPA 262.
4. Lead Content: Less than 300 parts per million.

D. Ethernet Network Cabling: TIA-568-C.2 Category 6a cable with RJ-45 connectors.
1. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of category cable indicated.
2. Conductors: 100-ohm, 23 AWG solid copper.
3. Lead Content: Less than 300 parts per million.
4. Shielding: Shielded twisted pairs (FTP).
5. Cable Rating: By application.
6. Jacket: Gray thermoplastic.

E. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for control wiring and cable raceways.

2.21 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect factory-assembled equipment.

B. Equipment will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports for historical record. Submit reports only if requested.

2.22 VARIABLE REFRIGERANT FLOW SYSTEM OPERATING SEQUENCE

A. Each Indoor Unit shall be scheduled ON by the Central Controller CC-1 via Building Automation System (BAS/BMS) at the occupied times defined by the Owner.

B. For Outdoor unit coupled with a BC Controller, the indoor units shall be set to AUTO mode during occupied times. During unoccupied times the indoor units shall be set to HEAT or COOL based on outside air enthalpy conditions.

C. The Central Controller CC-1 shall set the occupied and unoccupied temperature set-points based on the owner's request. Temperature set-points may be changed at the RC (remote controller).

D. The CC-1 shall send PROHIBIT commands for prohibiting the MODE button at the local remote controller in the space during occupied and unoccupied times.

E. The CC-1 shall send PROHIBIT commands for prohibiting the ON/OFF button at the local remote controller in the space during occupied times only. The CC-1 shall send PERMIT commands for permitting the ON/OFF button at the local remote controller in the space during unoccupied times to allow for setback override.

F. During unoccupied times the CC-1 shall send the OFF command to the indoor unit at the start of unoccupied times and every two hours thereafter to reinforce the setback conditions. The CC-1 shall monitor the Room Temperature at the remote controller in the space and command the unit ON if the owner specified night setback limits are exceeded. The CC-1 shall send the COOL mode command when the upper limit is exceeded or the HEAT mode command when the lower limit is exceeded. The CC-1 shall send the upper or lower limit as the space temperature set-point during unoccupied time.

G. Display:
   1. CC-1 system graphic.
   2. CC-1 system on-off indication.
   3. CC-1 system occupied/unoccupied mode.
   4. Indoor Units:
      a. All OFF (Emergency Stop) Command.
      b. ON/OFF Command.
      c. Operation Mode Command.
      d. Set Temperature.
      e. Prohibit ON/OFF at Remote Controller.
      f. Prohibit Mode at Remote Controller.
      g. Prohibit Limit Temperature Setting Range.
      h. ON/OFF Status.
      i. Operation Mode State.
      j. Room Temperature.
      k. Fan Speed Command.

l. Fan Speed State.
m. Air Direction Command.
n. Air Direction State.
o. Alarm Signal (Unit).
p. Error Code (system).
q. Filter Sign.
r. Filter Sign reset.
s. Prohibit Filter Sign Reset.
t. Prohibit Set Temperature.
u. Network Communication State.
v. System Forced Off.

5. Outdoor Units:
   a. ON/OFF Command.
   b. Operation Mode Command.
   c. ON/OFF Status.
6. DOAS Ventilation Mode Command.
7. DOAS Ventilation Mode State.
8. Electric Preheat Coil:
   a. Refer to Section “Electric-Resistance Air Coils.”
9. Expansion Controller Communication State

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine products before installation. Reject products that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for piping and tubing to verify actual locations of connections before equipment installation.

D. Examine roughing-in for ductwork to verify actual locations of connections before equipment installation.

E. Examine roughing-in for wiring and conduit to verify actual locations of connections before equipment installation.

F. Examine walls, floors, roofs, and outdoor pads for suitable conditions where equipment will be installed.

G. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION, GENERAL

A. Clearance:
1. Maintain manufacturer's recommended clearances for service and maintenance.
2. Maintain clearances required by governing code.

B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.
1. Loose components shall be installed by manufacturer's service representative or system Installer under supervision of manufacturer's service representative.

C. Equipment Vibration Isolation Installation: Install equipment with vibration isolation device. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

3.3 INSTALLATION OF INDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.

C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.

D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.

E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.

F. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.

G. Attachment: Install hardware for proper attachment to supported equipment.

H. Grouting: Place grout under equipment supports and make bearing surface smooth.

3.4 INSTALLATION OF OUTDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Install outdoor units on support structures indicated on Drawings.

C. Roof-Mounted Installations: Install outdoor units on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, stainless-steel fasteners.
1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

2. Provide braided copper flexible connector, rated for refrigerant used, 650 PSI max working pressure, packless industries or equal on all main piping downstream of twinning kits/converging fittings prior to penetration through roof.
3. Vibration spring SLR type isolators (mason industries or equiv.) with rubber base pads, securely fastened to structural base and to VRF outdoor unit interstitial support steel. Spring isolator shall provide minimum 1" deflection or 10 times the static deflection of the roof deck from equipment weight - determined by structural engineer of record. At a minimum, provide spring isolators at each equipment base mounting hole location.
4. Use neoprene isolation collars on pipe clams when fastening piping to supports.
5. Use long radius sweeping copper ACR tube pipe bends where pipe enters building at first elbow into ceiling space to minimize refrigerant flow noise and vibration.

3.5 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping and tubing to permit valve servicing.

F. Install piping and tubing at indicated slopes.

G. Install piping and tubing free of sags.

H. Install fittings for changes in direction and branch connections.

I. Install piping and tubing to allow application of insulation.

J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.

K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 0517 "Sleeves and Sleeve Seals for HVAC Piping."

L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 0518 "Escutcheons for HVAC Piping."

3.6 INSTALLATION OF SYSTEM CONDENSATE DRAIN PIPING

A. General Requirements for Drain Piping and Tubing:
   1. Install a union in piping at each threaded unit connection.
   2. Install an adjustable stainless-steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
   3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:
      a. Details indicated on Drawings.
      b. Manufacturer's requirements.
      c. Governing codes.
      d. In the absence of requirements, comply with requirements of ASHRAE handbooks.
   4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
   5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.

B. Gravity Drains:
   1. Slope piping from unit connection toward drain termination at a constant slope of not less than one percent.

C. Pumped Drains:
   1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

3.7 INSTALLATION OF REFRIGERANT PIPING

A. Refrigerant Tubing Kits:
   1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
   2. Support tubing using hangers and supports indicated at intervals not to exceed 5 feet. Minimum rod size, 1/4 inch.
   3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.

B. Install refrigerant piping according to ASHRAE 15 and governing codes.

C. Select system components with pressure rating equal to or greater than system operating pressure.

D. Install piping as short and direct as possible, with a minimum number of joints and fittings. Do not use pipes of radical thickness 0.7 mm or less.

E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08 3113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

F. Install refrigerant piping and tubing in protective conduit where installed belowground.

G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.

H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:
   1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
   2. Install horizontal suction lines with a uniform slope downward to compressor.
   3. Install traps to entrain oil in vertical runs.
   4. Liquid lines may be installed level.

I. When brazing, remove or protect components that could be damaged by heat.

J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.

K. Joint Construction:
   1. Ream ends of tubes and remove burrs.
   2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
   3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
      a. Use Type BCuP (copper-phosphorus) alloy for joining copper fittings with copper tubing.
      b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.

3.8 INSTALLATION OF METAL HANGERS AND SUPPORTS

A. Comply with requirements in Section 230548.13 "Vibration Controls for HVAC".

B. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Comply with MFMA-103 for metal framing system selections and applications that are not specified.

E. Fastener System Installation:

1. Install powder-actuated fasteners, for use in lightweight concrete or concrete slabs less than 4 inches thick, in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
3. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

F. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 7200 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel.
1. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Piping and Tubing Insulation:
1. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
2. Shield Dimensions for Pipe: Not less than the following:
a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

N. Horizontal-Piping Hangers and Supports: Install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

3. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
4. Multiple horizontal pipes located indoors may use metal framing systems with split clamp attachment for each pipe in lieu if individual clevis hangers.
5. Pipe stands for horizontal pipes located outdoors.
6. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
7. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

O. Horizontal Piping Hanger Spacing and Rod Size: Install hangers for drawn-temper copper piping with the following maximum horizontal spacing and minimum rod sizes:
1. Sizes through NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

P. Vertical-Piping Clamps: Install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): If longer ends are required for riser clamps.

Q. Support vertical runs at roof, at each floor, and at midpoint intervals between floors, not to exceed 5 feet.

R. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified.

S. Use hangers, supports, and attachments with galvanized coatings unless otherwise indicated.

T. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

U. Trim excess length of continuous-thread hanger and support rods to 1 inch.

V. Hanger-Rod Attachments: Install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

W. Building Attachments: Install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

3.9 INSTALLATION OF PIPING AND TUBING INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Installation to maintain a continuous vapor barrier.

B. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are unavailable, 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. 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.

D. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

E. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 INSTALLATION OF DUCT, ACCESSORIES, AND AIR OUTLETS

A. Where installing ductwork adjacent to equipment, allow space for service and maintenance.

B. Comply with requirements for metal ducts specified in Section 23 3113 "Metal Ducts."

C. Comply with requirements for air duct accessories specified in Section 23 3300 "Air Duct Accessories."

D. Comply with requirements for air diffusers specified in Section 23 3713.13 "Air Diffusers."

E. Comply with requirements for registers and grilles specified in Section 23 3713.23 "Registers and Grilles."

3.11 ELECTRICAL INSTALLATION

A. Comply with requirements indicated on Drawings and in applicable Division 26 Sections.

B. To extent electrical power is required for system equipment, components, and controls, and is not indicated on Drawings and addressed in the Specifications, the design for such electrical power shall be delegated to VRF HVAC system provider.
1. Delegated design of electrical power to equipment, components and controls, and associated installation shall be included at no additional cost to Owner.

C. Connect field electrical power source to each separate electrical device requiring field electrical power. Coordinate termination point and connection type with Installer.

D. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

E. Comply with requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems" for grounding connections.

F. Install nameplate or acrylic label with self-adhesive back for each electrical connection indicating electrical equipment designation and circuit number feeding connection.
   1. Nameplate shall be laminated phenolic layers of black with engraved white letters. Letters at least 1/2 inch high.
   2. Locate nameplate or label where easily visible.

G. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or revised in this Section.
   1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
   2. Outlet boxes for cables shall be no smaller than 4 inches square by 2-1/8 inches deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
   3. Flexible metal conduit shall not be used.

H. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

I. Install manufactured conduit sweeps and long-radius elbows if possible.

J. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.12 SOFTWARE

A. Cybersecurity:
   1. Software:
      a. Coordinate security requirements with IT department.
      b. Ensure that latest stable software release is installed and properly operating.
      c. Disable or change default passwords to password using a combination of uppercase and lower letters, numbers, and symbols at least eight characters in length. Record passwords and turn over to party responsible for system operation and administration.
   2. Hardware:
      a. Coordinate location and access requirements with IT department.
      b. Enable highest level of wireless encryption that is compatible with Owner's ICT network.
      c. Disable dual network connections.

3.13 INSTALLATION OF SYSTEM CONTROL CABLE

A. Comply with NECA 1.

B. Installation Method:
   1. Install cables in raceways except as follows:
      a. Within equipment and associated control enclosures.

b. In accessible ceiling spaces where open cable installation method may be used.
c. In gypsum board partitions where cable may be enclosed within wall cavity.

2. Conceal raceway and cables except in unfinished spaces.

C. General Requirements for Cabling:
1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable.
5. Cables serving a common system may be grouped in a common raceway. Install control cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles or access panels.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals.
15. Do not bend cables in a radius less than 10 times the cable OD.
16. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

D. Balanced Twisted-Pair Cable Installation:
1. Comply with TIA-568-C.2.
2. Do not untwist balanced twisted-pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

E. Open-Cable Installation:
1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.

2. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Separation from EMI Sources: Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded cable from potential EMI sources including electrical power wiring and equipment.

3.14 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.15 GROUNDING INSTALLATION

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For low-voltage control cabling, comply with requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems."

3.16 IDENTIFICATION

A. Identify system equipment, piping, tubing, and valves. Comply with requirements for identification specified in Section 230553 "Identification for HVAC Piping and Equipment."
1. Refrigerant Signs: Medium-weight aluminum type with a baked enamel finish. Signs must be suitable for indoor or outdoor service. Signs must have a white background with red letters not less than 0.5 inches in height.
2. Installation Identification: Provide each new refrigeration system with a refrigerant sign which indicates the following as a minimum:
   a. Contractor's name.
   b. Refrigerant number and amount of refrigerant.
   c. The lubricant identity and amount.
   d. Field test pressure applied.

B. Identify system electrical and controls components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."
1. Identify each control cable on each end and at each terminal with a number-coded identification tag. Each cable shall have a unique tag.

3.17 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage VRF HVAC system manufacturer's service representative to advise and assist installers; witness testing; and observe and inspect

components, assemblies, and equipment installations, including controls and connections.

1. Field service shall be performed by a factory-trained and -authorized service representative of VRF HVAC system manufacturer whose primary job responsibilities are to provide direct technical support of its products.
    a. Additional factory-authorized representatives may assist with completion of certain activities only if supervised by manufacturer's employee. A factory-authorized representative shall not provide assistance without manufacturer's employee supervision.
2. Manufacturer shall provide on-site visits during the course of construction at installation milestones indicated. System Installer shall coordinate each visit in advance to give manufacturer sufficient notice to plan the visit.
    a. First Visit: Kick-off meeting.
    b. Second Visit: At approximately 25 percent completion of system(s).
    c. Third Visit: At approximately 50 percent completion of system(s).
    d. Fourth Visit: At approximately 75 percent completion of system(s).
    e. Fifth Visit: Final inspection before system startup.
3. Kick-off Meeting:
    a. Meeting shall include system Installer and other related trades with sole purpose of reviewing VRF HVAC system installation requirements and close coordination required to make a successful installation.
    b. Meeting shall be held at Project site and scheduled at a mutually agreed to time that occurs before the start of any part of system installation.
    c. Meeting shall cover the following as a minimum requirement:
        1) Review of latest issue of Contract Documents, Drawings, and Specifications, relevant to VRF HVAC systems.
        2) Manufacturer's installation requirements specific to systems being installed.
        3) Review of all relevant VRF HVAC system submittals, including delegated-design submittals.
        4) Required field activities related installation of VRF HVAC system.
        5) Project team communication protocol, contact information, and exchange of responsibilities for each party involved, including manufacturer, supplier, system Installer, and other related trades.
4. Site Visits: Activities for each site visit shall include the following:
    a. Meet with VRF HVAC system Installer to discuss field activities, issues, and suggested methods to result in a successful installation.
    b. Offer technical support to Installer and related trades as related to VRF system(s) being installed.
    c. Review progress of VRF HVAC system(s) installation for strict compliance with manufacturer's requirements.
    d. Advise and if necessary, assist Installer with updating related refrigerant calculations and system documentation.
    e. Issue a report for each visit, documenting the visit.
        1) Report to include name and contact information of individual making the visit.
        2) Date(s) and time frames while on-site.
        3) Names and contact information of people meeting with while on-site.

4) Clearly identify and list each separate issue that requires resolution. For each issue, provide a unique identification number, relevant importance, specific location or equipment identification, description of issue, recommended corrective action, and follow-up requirements needed. Include a digital photo for clarification if deemed to be beneficial.

5. Final Inspection before Startup:
   a. Before inspection, Installer to provide written request to manufacturer stating the system is fully installed according manufacturer's requirements and ready for final inspection.
   b. All system equipment and operating components shall be inspected. If components are inaccessible for inspection, they shall be made accessible before the final inspection can be completed.
   c. Manufacturer shall provide a comprehensive inspection of all equipment and each operating component that comprise the complete system(s). Inspection shall follow a detailed checklist specific to each equipment and operating component.
   d. Inspection reports for indoor units shall include, but not be limited to, the following:
      1) Unit designation on Drawings.
      2) Manufacturer model number.
      3) Serial number.
      4) Network address, if applicable.
      5) Each equipment setting.
      6) Mounting, supports, and restraints properly installed.
      7) Proper service clearance provided.
      8) Wiring and power connections correct.
      9) Line-voltage reading(s) within acceptable range.
      10) Wiring and controls connections correct.
      11) Low-voltage reading(s) within an acceptable range.
      12) Controller type and model controlling unit.
      13) Controller location.
      14) Temperature settings and readings within an acceptable range.
      15) Humidity settings and readings within an acceptable range.
      16) Condensate removal acceptable.
      17) Fan settings and readings within an acceptable range.
      18) Unit airflow direction within an acceptable range.
      19) If applicable, fan external static pressure setting.
      20) Filter type and condition acceptable.
      21) Noise level within an acceptable range.
      22) Refrigerant piping properly connected and insulated.
      23) Condensate drain piping properly connected and insulated.
      24) If applicable, ductwork properly connected.
      25) If applicable, external interlocks properly connected.
      26) Remarks.
   e. Inspection reports for outdoor units shall include, but not be limited to, the following:
      1) Unit designation on Drawings.
      2) Manufacturer model number.

3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Condensate removal acceptable.
13) Noise level within an acceptable range.
14) Refrigerant piping properly connected and insulated.
15) Condensate drain piping properly connected and insulated.
16) Remarks.

f. Inspection reports for indoor, dedicated outdoor air ventilation units shall include, but not be limited to, the following:
1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity settings and readings within an acceptable range.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.
18) Fan external static pressure setting.
19) Filter type and condition acceptable.
20) Noise level within an acceptable range.
21) Refrigerant piping properly connected and insulated.
22) Condensate drain piping properly connected and insulated.
23) Automatic dampers properly installed and operating.
24) Ductwork properly connected.
25) If applicable, external interlocks properly connected.
26) Remarks.

g. Installer shall provide manufacturer with the requested documentation and technical support during inspection.

h. Installer shall correct observed deficiencies found by the inspection.

i. Upon completing the on-site inspection, manufacturer shall provide a written report with complete documentation describing each inspection step, the result, and any corrective action required.

j. If corrective action is required by Installer that cannot be completed during the same visit, provide additional visits, as required, until deficiencies are resolved and systems are deemed ready for startup.
k. Final report shall indicate the system(s) inspected are installed according to manufacturer's requirements and are ready for startup.

B. Perform the following tests and inspections with the assistance of manufacturer's service representative:
1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Refrigerant Tubing Positive Pressure Testing:
1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than 1.5 times VRF HVAC system operating pressure, but not less than 600 psig, using dry nitrogen.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of 24 hours. Allowance for pressure changes attributed to changes in ambient temperature are acceptable.
4. Prepare test report to record the following information for each test:
a. Name of person starting test, company name, phone number, and e-mail address.
b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
c. Detailed description of extent of tubing tested.
d. Date and time at start of test.
e. Test pressure at start of test.
f. Outdoor temperature at start of test.
g. Name of person ending test, company name, phone number, and e-mail address.
h. Date and time at end of test.
i. Test pressure at end of test.
j. Outdoor temperature at end of test.
k. Remarks:
5. Submit test reports for Project record.

D. Refrigerant Tubing Evacuation Testing:
1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing positive-pressure testing, evacuate tubing systems to a pressure of 500 microns.

3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of one hour(s) with no change.
4. Prepare test report to record the following information for each test:
   a. Name of person starting test, company name, phone number, and e-mail address.
   b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
   c. Detailed description of extent of tubing tested.
   d. Date and time at start of test.
   e. Test pressure at start of test.
   f. Outdoor temperature at start of test.
   g. Name of person ending test, company name, phone number, and e-mail address.
   h. Date and time at end of test.
   i. Test pressure at end of test.
   j. Outdoor temperature at end of test.
   k. Remarks:
5. Submit test reports for Project record.
6. Upon successful completion of evacuation testing, system shall be charged with refrigerant.

E. System Refrigerant Charge:
1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult variable refrigerant system manufacturer to determine the correct system refrigerant charge.
2. Installer shall charge system following VRF HVAC system manufacturer's written instructions.
3. System refrigerant charging shall be witnessed by system manufacturer's representative.
4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

F. Products will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.18 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.
1. Service representative shall be a factory-trained and -authorized service representative of VRF HVAC system manufacturer.
2. Complete startup service of each separate system.
3. Complete system startup service according to manufacturer's written instructions.

B. Startup checks shall include, but not be limited to, the following:
1. Check control communications of equipment and each operating component in system(s).

2. Check each indoor unit's response to demand for cooling and heating.
3. Check each indoor unit's response to changes in airflow settings.
4. Check each indoor unit, HRCU, and outdoor unit for proper condensate removal.
5. Check sound levels of each indoor and outdoor unit.

C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.
1. Installer shall correct deficiencies found during startup service for reverification.

D. System Operation Report:
1. After completion of startup service, manufacturer shall issue a report for each separate system.
2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.
3. Manufacturer shall electronically record not less than two hours of continuous operation of each system and submit with report for historical reference.
a. All available system operating parameters shall be included in the information submitted.

E. Witness:
1. Invite Owner and Commissioning Agent to witness startup service procedures.
2. Provide written notice not less than 20 business days before start of startup service.

3.19 ADJUSTING

A. Adjust equipment and components to function smoothly and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.

C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.

D. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.20 PROTECTION

A. Protect products from moisture and water damage. Remove and replace products that are wet, moisture damaged, or mold damaged.

B. Protect equipment from physical damage. Replace equipment with physical damage that cannot be repaired to new condition. Observable surface imperfections shall be grounds for removal and replacement.

C. Protect equipment from electrical damage. Replace equipment suffering electrical damage.

D. Cover and seal openings of equipment to keep inside of equipment clean. Do not remove covers until finish work is complete.

3.21 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of system Installer who are manufacturer's authorized service representative. Include four service visits for preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper equipment and system operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.22 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
   1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.23 DEMONSTRATION

A. Engage a VRF HVAC system manufacturer's factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain entire system.

B. Instructor:
   1. Instructor shall be factory trained and certified by VRF HVAC system manufacturer with current training on the system(s), equipment, and controls that are installed.
   2. Instructor's credentials shall be submitted for review by Commissioning Agent before scheduling training.
   3. Instructor(s) sole job responsibility shall be Owner training.
   4. Instructor(s) shall have not less than three years of training experience with VRF HVAC system manufacturer and past training experience on at least three projects of comparable size and complexity.

C. Schedule and Duration:
   1. Schedule training with Owner at least 20 business days before first training session.
   2. Training shall occur before Owner occupancy.

3. Training shall be held at mutually agreed date and time during normal business hours.
4. Each training day shall not exceed eight hours of training. Daily training schedule shall allow time for one-hour lunch period and 15-minute break after every two hours of training.
5. Perform not less than eight total hours of training.

D. Location: Owner shall provide a suitable on-site location to host classroom training.

E. Training Attendees: Assume three people.

F. Training Attendance: For record purposes, document training attendees at the start of each new training session. Record attendee's name, signature, phone number, and e-mail address.

G. Training Format: Individual training modules shall include classroom training followed by hands-on field demonstration and training.

H. Training Materials: Provide training materials in electronic format to each attendee.
1. Include instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
2. Video record each classroom training session and submit an electronic copy to Owner before requesting Owner acceptance of training.

I. Acceptance: Obtain Commissioning Agent or Owner written acceptance that training is complete, and requirements indicated have been satisfied.

END OF SECTION 23 8129

SECTION 23 8216.14 - ELECTRIC RESISTANCE AIR COILS

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 electric resistance air coils.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each air coil.
2. Include rated capacities, operating characteristics, and pressure drops for each air coil.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which coil location and ceiling-mounted access panels are shown and coordinated with each other.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air coils to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. ASHRAE Compliance: Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

2.2 COILS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Brasch Manufacturing Co., Inc.
2. Chromalox.
3. Dunham-Bush, Inc.
4. INDEECO.
5. Trane.

B. Testing Agency Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Coil Assembly: Comply with UL 1995.

D. Heating Elements: Open-coil resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, and fastened to supporting brackets. Coils shall be machine crimped into stainless steel terminals extending at least 1-inch into the air stream and all terminal hardware shall be stainless steel. Derated 25 or 35 watts per square-inch, as required.

E. High-Temperature Coil Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box without removing heater from duct or casing.

1. Secondary Protection: Load-carrying, manually reset or manually replaceable, thermal cutouts; factory wired in series with each heater stage.

F. Frames: Galvanized-steel channel frame, minimum 0.064 inch thick for slip-in or flanged mounting. Include intermediate element support brackets equally spaced at a maximum of 36 inches o.c. across electric-resistance air coil. Protective screen on both sides to protect personnel from accidental contact with electrically hot open coil elements, and to avoid large airborne contamination from reaching the elements.

G. Terminal Box/Control Panel: Insulated terminal box with overhang, remote mounted with door interlocked disconnecting means and overcurrent protection.

1. Enclosure: NEMA 250, Type 12 enclosure complying with UL 50.
2. Full-face-hinged door with lock and key latching device(s).
3. Factory insulate terminal box to prevent condensation from occurring within box and to minimize heat loss.
4. Install a laminated elementary wiring diagram on inside face of heater control panel door or in another protected location than visible be service personnel. Wiring diagram to match installation.

H. Include the following controls:

1. Safety Controls: Each heater is to be provided with the following factory-mounted safety controls:

    a. Disk-type thermal cutout switch with automatic reset.
    b. Primary linear thermal limit cutout switch with automatic reset.
    c. Secondary linear thermal limit cutout switch with local manual reset.
    d. Airflow Proving Switch: Pressure differential type; with pressure range selected to ensure reliable operation throughout full range of air-handling unit airflow down to minimum airflow indicated.

2. Staging Control: Disconnecting type, magnetic contactors for switching stages of heat.
3. SCR Control: Silicone-controlled rectifier (SCR) for 100 percent stepless capacity control. Indeeco Code E36 & E23. SCR's shall have field switchable temperature inputs for: 4-20 mA, 0-10 VDC for building automation control. Include SCR power controller with the following:

    a. Failsafe circuitry for shorted or opened input
    b. LED status lights for: power on and system operation
    c. Equip all SCR's with transient/surge absorbers
    d. Zero cross firing SCR's
    e. Snubber network protection against false firing
    f. Control circuit is to be optically isolated from the power circuit.
    g. SCR is to be suitable for indoor, dusty, and wet or outdoor applications as specified in the schedule.

4. Remote Monitoring and Control: Include control devices necessary to interface with remote-control signals, including the following:

    a. Heater on/off control.
    b. Monitoring heater on/off status.
    c. High-temperature alarm.
    d. Low-airflow alarm.
    e. Heater capacity control.

5. Toggle switches; one per step.
6. Fuses per NEC.
7. Time-delay relay.
8. 24-volt fan relay to provide a positive electrical interlock between the fan motor and the heater.
9. Disconnect switch-control circuit fan relay.
10. Magnetic contactor, disconnecting type.
11. Fuses per NEC.
12. Control circuit transformer with fused primary and secondary.

I. Electrical:

1. Single-Point Field Power Connection: Install and wire the heater to accommodate a single field electrical connection for electrical power.

2. Disconnecting Means: Provide each heater with a main electrical power connection, door mounted and interlocking, and disconnecting means to prevent access into panel, unless switched to the off position.

    a. Non-fused disconnect switch with lockable handle.
    b. Minimum Short-Circuit Current Rating: As required by electrical power distribution system, but not less than 42,000 A.

3. Factory install and wire branch circuit fusing or circuit breakers in accordance with NFPA 70.
4. All three-phase heaters shall have equal, balanced, three-phase stages. All internal wiring shall be stranded copper with 105 deg. C minimum insulation and shall be terminated in crimped connectors or box lugs.
5. Pilot Lights: Include labeled pilot lights on face of control panel for the following:

    a. Power on.
    b. Low-airflow alarm.
    c. High-temperature alarm.
    d. One for each stage on.

6. Terminations: Wire terminations and field interface terminations to labeled terminal strips.
7. Control Transformer: Size control circuit transformer for load. Fused primary.
8. Labeling: Label each electrical device with a laminated phenolic tag.
9. Use only NRTL-labeled electrical components.

J. Nameplate: Include the following data:

1. Manufacturer name, address, telephone number, and website address.
2. Manufacturer model number.
3. Serial number.
4. Manufacturing date.
5. Coil identification (indicated on Drawings).

K. Thermostats: Duct-mounted DDC Temperature Sensor, with temperature range from 30 to 90 deg F, and 2.5 deg F throttling range.

2.3 OPERATING SEQUENCE

A. Heating Coils, Electric: Discharge air temperature sensor modulates stages of heating coil to provide tempered supply air temperature set point of 40 deg. F (adjustable) to each DOAS or ERV unit. Interlock each duct heater with the respective DOAS or ERV unit to energize and modulate whenever outside air temperature is below 35 deg F (adjustable).

B. Indicate the following on the BAS operator's workstation display terminal and/or VRF System Central Controller:

1. DDC system graphic.

2. DDC system on-off indication (operating or not operating).
3. DDC system occupied/unoccupied mode.
4. Outdoor-air-temperature indication.
5. Heating-coil leaving-air-temperature indication.
6. Heating-coil leaving-air-temperature set point.
7. Heating-coil stage(s) in operation.
8. Each alarm.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install coils level and plumb.

B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

C. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

3.3 CONNECTIONS

A. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

C. Install electrical devices and remote terminal box furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

C. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After electrical circuitry has been energized, operate electric coils to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Prepare test and inspection reports.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain electric resistance air coils.

END OF SECTION 23 8216

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SECTION 26 0500 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Drawings and general provisions of the Contract, including General and Supplementary condition and General Requirements, and Division 1 specifications apply to the work specified in specifications of Division 26.

B. This section includes general administrative and procedural requirements for electrical installations. The administrative and procedural requirements such as Submittal, Operating and Maintenance Manuals, Handling, and storage of equipment, etc. are included in this section to expand the requirements specified in Division 1.

1.2 SCOPE

A. The work of all sections of Division 26 includes furnishing and installing the material, equipment and systems complete as specified therein and indicated on drawings. The electrical installation when finished shall be complete and coordinated, whole and ready for satisfactory use.

B. Specifications are intended to include everything necessary for a first-class installation. If mention has been omitted herein of any items of the work or materials usually furnished for, or necessary, for the complete installation of electrical work or if there are conflicting points in the specifications and/or drawings, the attention of the Owner or their representative should be called to such items in sufficient time for a formal addendum to be issued. Any and all conflicting points in the specifications and/or drawings which are not questioned by the Contractor and clarified by a formal addendum prior to opening of bids shall be subject to the interpretation of the Owner or their designated representative after award of the contract and his/her interpretation shall be binding upon the Contractor.

C. All materials and equipment shall be installed and completed in a first-class and workmanlike manner and in accordance with the best modern methods and practices. Any materials installed which do not present an orderly and reasonably neat or workmanlike appearance, or are not installed in accordance with these specifications, or the contract drawings, shall be removed and replaced when so directed in writing by the Owner or their designated representative at the Contractor's expense.

D. Should the Contractor discover any discrepancies between actual conditions and those indicated pertaining to the existing work which may prevent following good practice or the intent of the drawings and specifications, the Contractor shall notify the construction manager and shall not proceed with the work until instructions have been received from the Owner or their designated representative.

E. The Contractor shall furnish and install all labor, materials, equipment, tools, and services necessary for and reasonably incidental to furnishing and completing the installation of all electrical work, including the installation of conduits, wires, boxes, devices, etc. as shown on the

contract drawings and/or called for in the specifications, and deliver it to the Owner in proper working condition.

F. It is intended that the specifications and drawings include everything requisite and necessary to complete the entire work properly, notwithstanding the fact that every item involved may not be specifically mentioned.

G. The specifications outlines, in general manner, the work required to be performed by the Contractor. The Contractor is responsible for work which may be reasonably interpreted from the specifications and/or drawings as necessary for a complete installation ready for service. The words "install" and/or "installation" shall be interpreted as the inclusion of the following work:

1. Setting, plumbing, aligning, and anchoring of equipment on foundations
2. Placing all mounting bolts, base channels, cable clamps and supports
3. Mounting and connecting of electrical items shipped separately and removing and replacing equipment parts to facilitate handling
4. Making internal connections on equipment which were omitted for shipment. Provision of jumpers and local temporary interconnections that may not be listed in the cable tabulations at no additional cost to the Owner
5. Cleaning and checking of electrical equipment and connections
6. Repair to damaged surfaces and equipment shall be made to the satisfaction of the construction manager at no additional cost to the Owner.

H. The Contractor shall protect work in progress from physical damage and against the intrusion of dirt. The work area shall be kept clear of debris to prevent interference with other operations. The Contractor will be solely responsible for all refuse, debris, and trash attributable to this work. Removal shall be in accordance with all applicable ordinances and the Contractor shall pay any and all fees associated with the disposal of rubbish.

1.3 RESPONSIBILITY

A. The general Contractor shall be responsible for all work included in Division 26 and the delegation of work to subcontractors shall not relieve him of his responsibility. The term "contractor" is used throughout this Division and shall mean the General Contractor, although the actual performance of the work may be by a Subcontractor.

B. The Contractor shall carefully examine all plans, specifications, and documents. After careful examination of all documents, the Contractor shall visit the construction site and thoroughly acquaint himself with the conditions under which the work will be executed. Lack of knowledge, and the items, which could have been discovered or detected at the time of field visit will not be considered acceptable for extra work compensation.

1.4 REFERENCES AND DEFINITIONS

A. The following are definitions of the terms and expressions used in Division 26 Sections:

Construction Manager:	Owner's designated representative
Provide:	"furnish and install"
Directed:	"directed by the Engineer or Owner"

Indicated:	"Indicated in contract drawings"
Concealed:	"hidden from normal sight; includes items in shafts, duct spaces (chases), and above ceilings.
Exposed:	"not concealed"

B. Listed: Equipment or device is listed of a kind mentioned which:

1. is published by a nationally recognized laboratory which makes periodic inspections of production of such equipment.
2. states that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

C. Labeled: Equipment or device is labeled when:

1. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
2. The laboratory makes periodic inspections of the production of such equipment.
3. The labeling indicates compliance with nationally recognized standards or tests to determine the safe use in a specified manner.

D. Certified: Equipment or product is certified which:

1. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
2. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
3. Bears a label, tag or other record of certification.

E. Nationally recognized testing laboratory: Is a company, which is approved, in accordance with OSHA regulations, by the Secretary of Labor, Federal Government.

1.5 CODES, REGULATIONS AND PERMITS

A. Give all necessary notices and obtain all required permits. Pay all fees and other costs, including utility connections in connection with the work. File all necessary plans, prepare all documents and obtain all necessary permits and approvals from all governmental agencies having jurisdiction. Obtain all required certificates of inspection and deliver same to the construction manager before request for acceptance and payment for the work.

B. All materials furnished, and all work installed, shall comply with the latest editions in effect at the time and date of invitation of bids, of codes, standards, rules and regulations and recommendations of the bodies, such as:

1. American National Standards Institute (ANSI)
2 American Society of Testing and Materials (ASTM)
3. Insulated Power Cable Engineer Association (IPCEA)
4. National Electrical Code (NEC)
5. National Electrical Manufacturers Association (NEMA)
6. National Fire Protection Association (NFPA)

7. Occupational Safety and Health Agency (OSHA)
8. Underwriters Laboratories, Inc. (UL)
9. National Electrical Safety Code (NESC)
10. Institute of Electrical and Electronics Engineers
11. International Building Code (IBC)
12. American Disability Act (ADA)
13. Local Authority Having Jurisdiction

C. Drawings and specifications shall govern in those instances, where the requirements indicated on the construction documents are greater than the requirements required by applicable codes and other standards, rules and regulations.

1.6 SUBMITTALS

A. MATERIALS LIST

1. See Division 1 and General Requirements.

B. SHOP DRAWINGS

1. After receiving approval of the equipment manufacturers, and prior to delivery of any materials to job site, the Contractor shall submit for approval detailed dimensional ship drawings, together with descriptive specifications and engineering data sheets and catalog cuts showing construction size, arrangement, operating clearances, performance characteristics and capacity of all electrical materials, equipment and systems.
2. Shop drawings, catalog cuts etc. submitted for approval shall be properly labeled indicating: specific service for which material or equipment is to be used; section and article number of specific service for which material or equipment is to be used; section and article number of specifications governing; and Contractors name, Owner project name and number, and the date of submittal. Provide a cover sheet with each submittal.
3. Shop drawings, catalogs, pamphlets, or other documents submitted to describe items on which approval is being requested shall contain detailed and specific information which will demonstrate fully that the material, equipment or system will conform and perform to the contract documents. Each shop drawing, catalog pamphlet, etc. shall be clearly marked in ink and highlighted to identify the specific item submitted. Data of a general nature will not be accepted.
4. Shop drawings shall include plans, elevations, sections, mounting, details of component parts, point to point interconnection diagrams, elementary diagrams, single line diagrams and any other drawings necessary to show the fabrication and connection of the complete item or system.
5. The acceptance of shop drawings shall not relieve the Contractor from his responsibility to furnish material, equipment and systems and perform work required by the contract documents. Neither the Owner nor the architect nor the engineer will be responsible for errors or omissions on shop drawings furnished by the Contractor even though such shop drawings containing errors or omissions are inadvertently accepted.
6. The Contractor is further advised that the Owner, the architect; and/or the engineer will not act as coordinator between suppliers and subcontractors. All required coordination shall be the responsibility of the Contractor. See other sections of these specifications for additional detailed requirements for wiring diagrams, schematic diagrams, interconnection diagrams and similar shop drawings for systems and equipment.

7. Submit drawings and data sheets giving full information as to dimensions, materials, fitness and other pertinent facts.
8. Obtain approval before apparatus involved is ordered, built, or installed. If material of equipment is installed by the Contractor prior to receipt of pertinent shop drawings marked "No Exceptions Taken" or "Comments Noted", the Contractor shall be liable for its removal and replacement at no extra charge to Owner.
9. See other sections of Division 26 and Division 1 for additional detailed requirements of shop drawings.
10. Manufacturer's model and catalog number change frequently and may not necessarily include specified or required features and may not insure compatibility with supporting systems or intended applications. Contractor shall be responsible to insure that all materials and equipment delivered to the job site is suitable for the intended application and indicated connections.
11. Review of and/or noted comments on the contractor's submitted shop drawings do not constitute a change order or a waiver of contract requirements. In the event of conflict between submittals or shop drawings and contract documents, the later shall govern. If a waiver of particular requirement is requested by the contractor, a formal written request shall be made to owner as per general conditions.

C. OPERATING AND MAINTENANCE MANUALS

1. Refer to Division 1 Section "Operation and Maintenance Data" for documentation requirements and format of the Building Systems Manuals.
2. Each copy of the Operating and Maintenance Manuals shall be bound in a durable, hardback binder with data sheets individually punched or perforated and entered. Data sheets shall be grouped and separated by dividers. At the Contractor's option, the manual may contain heavy manila tie flap envelopes, punched and bound with data sheets inserted in the envelopes and with a typed label on each envelope to identify its contents.

   The manual shall have an identifying label on the front cover and shall include the following as a minimum:

   a. Index
   b. One copy of the approved materials list
   c. One copy each approved shop drawing and associated data
   d. One copy of each system or equipment manufacturer's recommended preventive maintenance, if any
   e. One copy of the nameplate data for each motor and overload protection device
   f. One copy of a time-current characteristic curve for each type of fuse, overload device, or protection relay
   g. One copy of each system or component operating and recommended preventive maintenance instruction (where applicable)
   h. Copy of each final test report
   i. Copy of manufacturer's installation instructions
   j. List of service locations and local parts suppliers, and spare parts list
   k. Wiring diagrams

1.7 WARRANTY

A. All material and equipment provided under this division shall be free from defects in workmanship and materials for a period of two years after date of certification of completion and acceptance of work. All defects in workmanship, materials, or performance which appear within the guarantee period shall be corrected by the Contractor on notice from the Owner or their designated representative, without cost to the Owner. In default thereof, Owner may have such work done by others and charge the cost of same to the Contractor.

1.8 SITE VISIT

A. Prior to preparing the bid, the Contractor shall visit the site and familiarize himself with existing conditions, make necessary investigations as to locations of existing equipment, utilities, etc. and all other matters which can affect work under the contract. No additional compensation will be paid to the Contractor as a result of his failure to completely familiarize himself with the existing conditions (under which the work must be performed), which could have been discovered at the site visit.

1.9 DRAWINGS

A. The drawings are diagrammatic and are intended to indicate general arrangement and manner of connections. They are not intended to show all details of construction or exact locations of the work. The exact final location of all electrical items shall be approved by the Engineer and Owner before installation.

B. The Contractor shall carefully examine all contract documents and shall be responsible for the proper fitting of all materials and equipment.

C. Although the location of materials and equipment may be shown on the drawings in a certain place, the construction may develop conditions that render this location inaccessible or impractical. The Contractor shall call the condition to the attention of the Owner or their designated representative for his direction, before fabricating and installing the work. When requested by the Owner or their designated representative, a detailed drawing of the proposed departure due to field conditions or their causes shall be submitted by the Contractor for approval. The Owner, or their designated representative, shall make all final written decisions as to the conditions which require the changing of any work.

D. A reasonable shifting in the locations of outlets before installation is expected and shall be done at no increased cost to the owner.

E. It is the intention and requirement of the specification that proper service be provided to and for all pieces of equipment requiring same. As far as possible, the proper service to each piece of equipment has been indicated on the plans. The Contractor shall verify the service requirements of all pieces of equipment before making final provisions. Shop drawings shall be obtained for check before installation. The Contractor shall also check the exact point of connection so that service for each piece of equipment may be brought to the proper location.

1.10 TEMPORARY POWER FOR CONSTRUCTION AND LIGHT

A. The Contractor shall provide temporary power for construction and power. All costs associated with temporary power, such as permits, fees, etc. shall be paid by Contractor. Temporary wiring

shall be maintained by Contractor in a safe operating condition for all areas where work is in progress.

B. All temporary work shall be in accordance with the latest OSHA, State of Maryland and local authorities having jurisdiction safety requirements and shall be completely removed upon completion of the project.

C. Permanent building power wiring and equipment can be used as temporary power for construction power and light, with the written approval from the County.

1.11 ELECTRICAL SYMBOLS

A. Electrical equipment indicated on plans by symbols shall be taken to mean a complete installed device, including all items as may be required by the NEC, or any other code or standard references and made a part of herein.

PART 2 - PRODUCTS

2.1 RELATED DOCUMENTS

A. All electrical materials and equipment shall be new, shall carry a UL label when such material, equipment, and/or systems are of a type or class listed by UL and shall be suitable for the conditions and duties imposed on them. If a UL label is not available from the manufacturer when requested or required by authorities having jurisdiction, then the equipment shall be tested by an approved electrical testing company in accordance with NEC, at no additional charge to the Owner. Submit data indicating compliance with standards prior to installation. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the specifications.

B. All component parts of each item of equipment or device shall bear the manufacturer's name plate, giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc. in order to facilitate maintenance or replacement. The nameplate of a subcontractor or distributor shall not be acceptable.

C. In specifying materials, three general procedures are used. The three classifications are as follows:

1. Group 1: When the material or equipment is specified by name or other identifying information and one name brand only is used, it is considered that the use of that particular item is essential to the project and the Contractor shall base his proposal on the cost of that item. Where any item of material or equipment is specified by proprietary name, trade name or manufacturer, it is understood that the item named, is intended to be used.
2. Group 2: When the material or equipment is specified with the phrase "or approved equal..." after a brand name and other identifying information, it is intended that the brand name used is for the purpose of establishing a minimum acceptable standard of quality and performance and the Contractor may base his bid proposal on any item which is in all respects equal or better to that specified and presents essentially the same appearance, size, operation, performance, and will fit in the available space.

3. Group 3: When material is specified as complying with the requirements of published "Standard Specification" of trade associations, ANSI, ASTM, government specifications, etc. the Contractor shall base his proposal on any item which can be shown to comply in all respects with the referred "Standard Specification".

D. It is distinctly understood:

1. That the Owner or their designated representative will use his own judgment in determining whether or not any materials, equipment or methods offered for approval as an equal are equal to those specified and will fit the space available.
2. That the decision of the architect/engineer on all such question of equality is final
3. All acceptable material, equipment or methods will be provided at no increase in cost to the Owner

E. Upon receipt of written notice from the Owner or their designated representative that the material, equipment or methods have been reviewed and accepted (no exceptions taken or comments as noted), the Contractor may proceed with the accepted equal material, equipment or methods, providing the Contractor assumes full responsibility for and performs any change or adjustment in construction, such as clearances in accordance with NEC, Article 110 and/or as recommended by equipment manufacturer, that may be required by the use of such materials, equipment or methods, including services provided under other divisions at the Contractor's expense.

F. In the event of adverse decisions by the Owner of their designated representative, no claim of any sort shall be made or allowed against the Architect or the engineer or the Owner.

2.2 INSTALLATION

A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate electrical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for concrete pads, chases, slots, and openings in other building components during progress of construction, to allow for electrical 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 electrical 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 mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. 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 Engineer and Owner.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

9. Install electrical 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.
10. Install access panel or doors where units are concealed behind finished surfaces.
11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

2.3 EQUIPMENT SUPPORTS, FOUNDATIONS AND STANDS

A. The Contractor shall provide all supports, foundations and stands required for the electrical equipment and shall provide, align and set all necessary anchor bolts.

B. Where equipment is indicated or specified to be floor mounted stands shall be constructed of structural steel sections (or steel pipe and fittings braced and fastened with flanges) bolted to the floor.

C. Concrete pads shall be not less than four inches high unless otherwise indicated on drawings and shall extend minimum six (6) inches beyond the equipment base on all sides. Exposed edges and corners shall be chamfered and exposed surfaces shall be finished smooth.

D. All conduit penetrations through floor slabs or other fire rated walls shall be complete with fire seals as manufactured by OZ Gedney "Fire Stop" or equal UL approved.

2.4 NAMEPLATES AND LABELS

A. All transformers, panelboards, circuit breakers, control equipment, and instrumentation, etc. shall be provided with engraved laminated black and white phenolic nameplates with beveled trim. Data and installation shall be approved by the Owner or his designated representative. Nameplate lettering shall be minimum 1/8" high etched letters. All nameplates shall be fastened with screws without altering the NEMA classification of the enclosure.

B. All wiring in junction boxes, pull boxes, etc shall be identified as to point of origin and termination. Tagging of such circuits shall be permanent. Paper or tape tags are not acceptable.

PART 3 - EXECUTION

3.1 COORDINATION OF WORK

A. The Contractor shall have a competent foreman on the premises at all times to check, layout, and superintend the installation of the work shown on the drawings and described in these specifications. He shall provide information regarding location and sizes of chases and openings and shall be responsible for the accuracy of such information. The foreman shall layout and superintend the installation of all hangers, inserts, sleeves and other work in masonry and concrete in advance of and during construction, giving consideration to the work of other trades to prevent interference in the location of other equipment.

B. Exact locations of electrical equipment, conduits, panels, etc. and other electrical work shall be coordinated with all other trades and there will be no interference between the trades. Where

conflicts result, they shall be resolved by the Contractor to the satisfaction of the Owner or their designated representative at no expense to the Owner.

3.2 OUTAGES

A. The Contractor shall perform all work with a minimum duration of electrical outages.

B. All outages shall be approved by Owner and shall be scheduled at the convenience of the Owner.

C. Any losses caused by non-coordination outages shall be the responsibility of the Contractor and such loses shall be replaced at the Contractor's expenses.

3.3 WORKMANSHIP

A. Workmanship shall be of the highest quality obtainable in the trade working with the materials specified. Workmanship shall be satisfactory to the Owner or his designated representative and his decision as to acceptable quality is final.

B. All work shall be performed by skilled electricians and mechanics in the trades involved.

3.4 OVERTIME

A. Any work required to be performed at other than normal working hours (nights, holidays, weekends, etc.) shall be taken into consideration by the Contractor when computing the bids. Extra compensation shall not be allowed to the Contractor for any work performed at other than normal working hours.

3.5 HANDLING AND STORAGE OF MATERIALS

A. Paper and suitable tools, equipment and appliances for the safe and convenient handling and placing of all materials and equipment shall be used. During loading, unloading, and placing, care shall be taken in handling the equipment or materials, so that no equipment or materials are damaged.

B. All electrical material and equipment delivered to the job site shall be under roof or other approved covering, on pedestals above ground. All enclosures for equipment shall be weatherproof.

C. Provide physical protection for equipment and materials during storage as follows:

1. Equipment stored outdoors shall be supported at least eight (8) inches above ground.
2. Provide temporary wiring, heat lamps, or heating elements as required to prevent condensation of moisture in equipment, at no additional cost to the Owner.
3. Storage facilities are subject to approval of the Owner or his construction manager.

C. Thoroughly check and list all equipment received and provide the Owner's construction manager with a complete itemized list. The list shall include any damage or missing parts or equipment.

D. The Contractor shall be held accountable for all material and equipment received by him as evidenced by the list prepared by the Contractor and in the event of loss or disappearance of or damage to any such material or equipment, the Contractor shall replace such items without additional cost to the Owner.

E. Storing and maintaining materials and equipment after receipt until the completed installation is accepted by the Owner. Such storage and maintenance shall be in accordance with the manufacturer's recommendations and the requirements of these specifications. The Contractor shall be accountable for any deterioration of materials or equipment occasioned by improper storage or maintenance and shall recondition, repair, or replace any such deteriorated materials or equipment without additional cost to the Owner.

1. Electrical conduit shall be stored so as to provide protection from the weather and accidental damage. Plastic conduit shall be stored on even supports and in locations not subject to direct sun rays or excessive heat.
2. Cables shall be sealed, stored and handled carefully to avoid damage to the outer covering or insulation and damage from moisture and weather.

F. Materials and equipment which are found to be defective or damaged as a result of improper handling and or storage, shall be subject to removal, at the direction of the Owner or his designated representative and replaced with new materials and equipment with no additional cost to the Owner.

3.6 EQUIPMENT CONNECTIONS

A. All equipment requiring electrical service shall be installed and connected in accordance with the latest codes, contract documents, the best engineering practices and in accordance with manufacturer's recommendations.

B. Equipment connections indicated on drawings shall be considered diagrammatic. The actual connections shall be made to best suit the requirements of each case and to minimize the space used.

C. All conduit, outlets, wiring and all necessary fittings or accessories for connections to all electrical equipment shall be provided. All equipment ratings shown on the drawings are for the specified equipment. Should equipment of different ratings be furnished, all circuit components shall be adjusted accordingly, at the Contractor's expense, after approval by the Owner or his designed representative. The Contractor shall be responsible for confirming the proper size and location of each equipment connection before fabrication and installation of work.

D. The Contractor shall be responsible to reach an agreement as to the limits of responsibility of the various trades when connecting to the outlets provided by others, and when providing outlets to receive connections by others, so that all work and equipment will be provided with the proper services connected and ready for use.

3.7 WATERPROOFING

A. All waterproofing and damp-proofing of the building shall be held unharmed by the installation of work under this division. Wherever any of the work or conduits under this division pierce

waterproofing and damp-proofing, including outside walls, such penetrations shall be made only when approved by the Owner or their designated representative and the pierced surface shall be made watertight. Any waterproofing damaged or destroyed shall be replaced at the Contractor's expense.

3.8 CUTTING, PATCHING AND PAINTING

A. All cutting, patching and painting necessary for the installation of the electrical work shall be done under Division 2. Any damage done to work already in place shall be redone at the Contractor's expense. Patching shall be uniform in appearance and shall match surrounding surfaces. Painting, wherever required, shall match existing paint.

B. All exposed equipment, including conduit installed under this Division, shall be cleaned and left in a condition ready for painting. All items not provided with a corrosion-resistant finish shall be painted. All electrical panels, control equipment, and supporting framework, except as indicated otherwise, shall have a light gray enamel finish which may be the manufacturer's standard gray, if acceptable to Owner. Where the finish becomes scratched or marred, it shall be touched up or repainted to match the original finish as directed by the construction manager. Particular caution shall be exercised so as not to obscure the nameplate.

3.9 SLEEVES AND PLATES

A. Sleeves shall be provided by the Contractor for the installation of conduit, etc. The sleeves shall be carefully located in advance of the construction of walls and floors where new construction is involved. Provide all cutting and patching necessary to set sleeves which are not placed prior to construction.

B. Sleeves shall be provided for all conduit, etc. passing through concrete, masonry, construction. Caulk the annular space of sleeves with an elastic fire resistant caulking compound to make installation fire, air and watertight.

C. Fasten sleeves securely in the construction so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster, or other materials being forced into space between conduits, etc. and sleeve during construction.

D. At all sleeves where objectionable noise can be transmitted, at smoke barriers, at walls above ceilings that extend to underside of the structure of floor above, or at fire rated separations, seal all openings between conduit, etc. and corresponding sleeves to prevent sound transmission and to maintain fire rating. Use UL approved resilient sealant for penetration seals. Submit method of sealing for approval. Where watertight sleeves are indicated or required to suite the installation, provide Link Seal rubber seals as manufactured by Thunderline Corporation, between pipes and sleeves.

E. Where conduit motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of conduit. Check construction to determine proper length for various locations; make actual lengths to suite conditions.

3.10 GROUNDING

A. The entire electrical installation shall be grounded in accordance with Article 250 of the National Electrical Code, National Electrical Safety Code, IEEE recommendations, and Underwriters Laboratories, Inc., latest editions.

3.11 TESTING AND INSPECTIONS

A. LOW VOLTAGE TESTING (600 VOLT OR LESS)

1. Upon completion of the work, the contractor shall in the presence of the owner, architect and engineer, operate, test, adjust, and retest if necessary, the complete electrical systems. All systems shall function fully and complete as intended in design, and are ready to be occupied.
2. The contractor shall furnish all labor, materials, supplies, equipment, instruments, and power necessary for measurements, testing and settings as required. The measurement, testing and setting shall demonstrate:

    a. That all the lighting, power, and control circuits are continuous and free from short circuits and other defects.
    b. That all the circuits are free from unspecified grounds
    c. That all circuits and equipment are properly connected in accordance with applicable wiring diagrams and are operable by demonstrating the functioning of each control device not less than ten (10) times and by continuous operation of each circuit for not less than one half hour.
    d. Measure the ground resistance of the electrical installations of grounding systems. The ground resistance shall not exceed 3 ohms as specified in Section 26 0526.
    e. Any other testing required under other section of Division 26 work.
    f. Make tests of each motor provided under Divisions 22 and 23 to measure the actual service parameters while the motor is operating at design duty conditions, including steady state full load amperes (FLA), voltage and power factor.
    g. Results of the above tests shall show the all the equipment and wiring meets the requirements of these specifications before being accepted by the engineer and owner. Should any of the above tests indicate defects in materials or workmanship, the faculty installation shall be repaired or replaced at once and the tests be re-conducted at contractor's expense.
    h. Operational Tests: the contractor shall note that certain other sections of these specifications require tests of the operation of various items of equipment. He shall familiarize himself with these requirements and where electrical controls are involved, in any of these tests, he shall furnish any services or materials required to make any electrical performance tests required.

3. All defects shall be repaired at once and tests re-conducted at contractor's expense.
4. For the purpose of these tests, normal and emergency conditions may be simulated during these tests if approved by the engineer. The services of the manufacturer's factory trained service engineer shall be provided to inspect the installation of all equipment furnished under this division to assure that is installed in accordance with the manufacturer's instructions, assist with startup and instruct operating personnel in the operation and maintenance of the equipment.

B. INSPECTION

1. All phases of the work shall be inspected by a local authorities having jurisdiction.
2. An electrical certificate from the local authorities having jurisdiction must be submitted to the owner prior to or with the final payment invoice.

3.13 FIELD QUALITY CONTROL

A. Perform indicated tests to demonstrate workmanship, operation, and performance.

1. Conduct tests in presence of Owner or his Representative and, if required, inspectors of agencies having jurisdiction.
2. Arrange date of tests in advance with Owner, manufacturer, and installer.
3. Give all inspectors minimum of one week notice.
4. Furnish all labor and materials required for period of test.

B. Repair or replace equipment and systems found inoperative or defective and retest.

1. If equipment or system fails retest, replace it with products, which conform with Contract Documents.
2. Continue remedial measures and retests until satisfactory results are obtained.

C. Test equipment and systems as indicated for each item, unless otherwise recommended by manufacturer.

D. Coordinate work of this section with work of other sections to insure timely delivery and installation of work.

3.16 ADJUSTING AND CLEANING

A. Inspect all equipment and put in good working order.

B. Clean all exposed and concealed items.

C. Comply with the requirements in Division 1.

3.17 TRAINING

A. Refer to Division 1 Section “Demonstration and Training” for electrical systems & components and electrical equipment.

B. Provide Training as specified in the above referenced specification section and the Division 26 technical specifications.

END OF SECTION 26 0500

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 SUBMITTALS

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

B. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70, “National Electrical Code”.

1.5 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation
3. Senator Wire & Cable Company.
4. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70. Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

C. Aluminum conductors are not acceptable.

D. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW, UF, USE, and SO.

1. Type USE-2 and Type SE: Comply with UL 854.
2. Type THHN and Type THWN-2: Comply with UL 83.
3. Type UF: Comply with UL 83 and UL 493.
4. Type XHHW-2: Comply with UL 44.

E. Multi-conductor cable: Copper conductors with insulated ground conductor. Comply with NEMA WC 70 for Metal Clad cable type MC.

F. Color Coding: Comply with the requirements in Section 26 0553 “Identification for Electrical Systems.”

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Power Systems, Inc.
2. O-Z/Gedney; EGS Electrical Group LLC.
3. 3M; Electrical Products Division.
4. Thomas & Betts Corporation.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: One or Two hole with standard or long barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders and Branch Circuits: Type XHHW-2, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2 single conductors in raceway.

D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN-2, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN-2, (Type XHHW for computer/nonlinear loads) single conductors in raceway. Use MC Cable only where acceptable to Owner.

1. MC Cable is not allowed for all interior dry locations concealed above ceiling or behind drywall. All wiring shall be run in EMT up to an accessible junction box in the room and MC cable can be run only to the lighting fixtures and motor whips (only for dry locations). Maximum length for MC cable allowed is 72 inches.
2. MC cables will not be allowed for home runs and 3 phase motor branch circuits
3. MC cables will not be allowed in any exposed location such as electrical rooms, mechanical rooms, theatres, performing spaces, studios, communication rooms, dimming rooms, AV rooms, etc. MC cables will not be allowed for any feeder wiring, for any damp and wet location, fire alarm system, security system and other special systems.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type RHW, single conductors in raceway.

G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

H. Class 1 Control Circuits: Type THHN-THWN, in raceway.

I. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

G. Identify and color-code conductors and cables according to Section 26 0553 “Identification for Electrical Systems."

H. Routing of raceways shall be in accordance with the penetration control plans. Penetrations through acoustically significant construction shall be sealed airtight in accordance with penetration control plans, resiliently sealed penetration details, and Section 07 9200 – “Joint Sealants”.

I. Low voltage and/or communication cables that penetrate acoustically significant construction, defined by the penetration control plans, should be minimally run in conduits from each room’s back boxes to a stub out in the hallway.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 8413 “Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Sections includes grounding and bonding systems and equipment.

1.3 SUBMITTALS

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

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Ground rods.
2. Grounding arrangements and connections for separately derived systems.
3. Grounding for sensitive electronic equipment.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells and ground rings based on NETA MTS and NFPA 70B.

    a. Tests shall determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    b. Include recommended testing intervals for each grounding system including Lightning Protection system.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled, rectangular bars of annealed copper, 1/4 inch by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inch apart.

D. Stand-off insulators shall comply with UL 891 for use in switchboards, switchgear, 600V, Lexan or PVC and impulse tested at 5000 V.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar connections: Mechanical type, cast silicon bronze, solderless, compression type wire terminals, and long-barrel, two-bolt connections to ground bus bar.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 3/4 inch in diameter by 10 feet long.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 LABELING

A. Comply with requirements in Section 26 0553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
b. Perform tests by fall-of-potential method according to IEEE 81.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System: 5 ohms.
2. Substations and Pad-Mounted Equipment: 5 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 0526

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70, “National Electrical Code”.

1.6 COORDINATION

A. Coordinate installation of equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation
d. Thomas & Betts Corporation.
e. Unistrut; Tyco International, Ltd.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners or Drive pin type fasteners: Not allowed
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 05 5000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Do not use powder actuated fasteners and drive pin type fasteners
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05 5000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 0529

SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Surface raceways.
3. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 07 8413 "Penetration Firestopping" for firestopping at conduit and box entrances.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. GRC: Galvanized rigid steel conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquid flexible metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

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. Allied Tube & Conduit; a part of Atkore International.
    b. Calconduit.
    c. Electri-Flex Company.
    d. NEC, Inc.
    e. Southwire Company.
    f. Thomas & Betts Corporation; A Member of the ABB Group.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

    a. Comply with NEMA RN 1.
    b. Coating Thickness: 0.040 inch, minimum.

6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Comply with NEMA FB 1 and UL 514B.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
5. Fittings for EMT:

    a. Material: Steel or die cast.
    b. Type: compression.

6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
7. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

C. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Wiremold / Legrand.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Crouse-Hinds, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Hubbell Incorporated.
4. Hubbell Incorporated; Wiring Device-Kellems.
5. Kraloy.
6. O-Z/Gedney; a brand of Emerson Industrial Automation.
7. RACO; Hubbell.
8. Thomas & Betts Corporation; A Member of the ABB Group.
9. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

J. Gangable boxes are prohibited.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 for indoor, Type 3R for outdoor with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: IMC.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: GRC up to 8 feet of finished floor. EMT above 8 feet from finished floor.
2. Exposed, Not Subject to Severe Physical Damage: Surface metal raceway, Wiremold 7000 with minimum two hole straps. EMT only where acceptable to Owner.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
b. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings.

F. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Complete raceway installation before starting conductor installation.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches of enclosures to which attached.

L. Stub-Ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

S. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

T. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

U. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

V. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

W. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Conduit extending from interior to exterior of building.
3. Conduit extending into pressurized duct and equipment.
4. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
5. Where otherwise required by NFPA 70.

X. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

Y. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Z. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

CC. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

DD. Locate boxes so that cover or plate will not span different building finishes.

EE. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

GG. Set metal floor boxes level and flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 0533

SECTION 26 0544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 07 8413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel].
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1, “Standard Practice for Good Workmanship in Electrical Construction”.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07 9200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed[or unless seismic criteria require different clearance.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 0544

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Identification for raceways.
2. Identification for conductors.
3. Warning labels and signs.
4. Instruction signs.
5. Equipment identification labels.
6. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1, “Scheme for Identification of Piping Systems” and ANSI C2, “National Electrical Safety Code”.

B. Comply with NFPA 70, “National Electrical Code”.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

E. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high letters on 20-inch centers.

D. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.3 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

C. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

E. Tag:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils.
3. Foil Core Thickness: 0.35 mil.
4. Weight: 28 lb/1000 sq. ft..
5. 3-Inch Tensile According to ASTM D 882: 70 lbf, and 4600 psi.

2.4 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a black background. Minimum letter height shall be 3/8 inch.

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch .

2.6 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. `Paint: Paint materials and application requirements are specified in Division 09 painting sections.

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Snap-around labels. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: A color coding system as listed below shall be used throughout the building's network of feeders and circuits and used as a basis of balancing the load. Match the Owner's color coding standard. If no standard color coding system exist, use the following:

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. All wires used solely for grounding purposes shall have green color if insulated.
c. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

d. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

e. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
f. Control Wiring: Color coded with wires of colors different from those used to designate phase wires.

E. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags.

F. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Devices to be Labeled:

a. Each receptacle outlet. Note that the receptacle labels shall be updated based on the balancing the loads for the panelboards.

3. Equipment to Be Labeled:

a. Identification labeling of some items listed below may be required by individual Sections or by NFPA 70.
b. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label. Update or replace directory of all existing panelboards affected by the work.
c. Enclosures and electrical cabinets.
d. Access doors and panels for concealed electrical items.
e. Switchboards.
f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
g. Emergency system boxes and enclosures.
h. Motor-control centers.
i. Enclosed switches.
j. Enclosed circuit breakers.
k. Enclosed controllers.
l. Variable-speed controllers.
m. Push-button stations.
n. Power transfer equipment.
o. Contactors.
p. Remote-controlled switches, dimmer modules, and control devices.
q. Power-generating units.
r. Monitoring and control equipment.

END OF SECTION 26 0553

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following lighting control devices:

1. Indoor occupancy sensors.
2. Switchbox-mounted occupancy sensors.
3. Lighting contactors.
4. Emergency shunt relays.

B. Related Sections include the following:

1. Section 26 2726 "Wiring Devices" for wall-box dimmers, and manual light switches.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

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

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. NSi Industries LLC. (TORK)
4. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the power pack/relay unit.
3. Power Pack/Relay Unit: Dry contacts rated for 20-A ballast or LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

a. Sensor: Suitable for mounting in any position on a standard outlet box.

b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: Digital display, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the "on" function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

C. Dual-Technology Type: Detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted 48 inches above finished floor.

2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Hubbell Building Automation, Inc.
3. Leviton Manufacturing Co., Inc.
4. NSi Industries LLC.
5. Square D.
6. WattStopper; a Legrand® Group brand.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox using hardwired connection.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.

4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft..
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, dual circuit. SP, manual "on," automatic "off." SP, field-selectable automatic "on," or manual "on," automatic "off."
4. Capable of controlling load in three-way application.
5. Voltage: Match the circuit voltage.
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
10. Color: White.
11. Faceplate: Color matched to switch.

2.3 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO: a brand of Vertiv.
3. Eaton.
4. General Electric Company.
5. Square D.

B. Description: Electrically operated and mechanically held, combination type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

C. Interface with HVAC: Provide hardware interface to enable the control system for HVAC to control lighting contactors and HVAC equipment for all ceiling mounted occupancy sensors.

1. Control: On-off operation.
2. Control: HVAC equipment

2.4 EMERGENCY SHUNT RELAY

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Lighting Control and Design, Inc.

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

1. Coil Rating: 120 and/or 277 V.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SENSOR INSTALLATION

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 CONTACTOR INSTALLATION

A. Comply with NECA 1.

B. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 3/4 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

A. Identify components and power and control wiring according to Section 26 0553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices that fail tests and inspections are defective work.

C. Prepare test and inspection reports.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Provide one (1) 2-hour training sessions to train the maintenance staff.

END OF SECTION 26 0923

SECTION 26 2416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. MCCB: Molded-case circuit breaker.

E. SPD: Surge protective device.

F. SVR: Suppressed voltage rating.

G. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types and details for types other than NEMA 250, Type 1.

4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1, “Panelboards.”

E. Comply with NFPA 70, “National Electrical Code.”

F. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.8 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types and shunt trip devices: Two spares for each panelboard.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush and surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
   c. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

   a. Panels and Trim: Steel, factory finished immediately after cleaning and pre-treating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   b. Back Boxes: Same finish as panels and trim.

7. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

B. Incoming Mains:

1. Location: Convertible between top and bottom.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: As suitable for nonlinear loads where indicated on the drawings.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Sub feed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Series rated panelboards will not be accepted.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 22,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

E. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
   d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   e. Shunt Trip: 120 -V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
   f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

2.4 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NEMA PB 1.1.

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

E. Mount top of trim 78 inches above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.

H. Install filler plates in unused spaces.

I. For all recessed panelboards, stub minimum of six (6) 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 0553 “Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 0553 “Identification for Electrical Systems."

D. Panelboard directories shall be corrected and re-created after balancing the loads to meet the specifications requirements and shall match with the actual loads in the field. A copy of the panelboard schedule from the construction documents will not be acceptable.

E. Install warning signs complying with requirements in Section 26 0553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

E. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to program, monitor, adjust, and operate the equipment.

3.6 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 2416

SECTION 26 2726 - 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. Receptacles, receptacles with integral GFCI, and associated device plates.
2. USB receptacles.
3. Tamper-resistant receptacles.
4. Weather-resistant receptacles.
5. Snap switches and wall-box dimmers.
6. Wall-switch

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
2. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
3. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70, "National Electrical Code".

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

F. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper
b. Hubbell
c. Leviton
d. Pass & Seymour

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following

a. Cooper
b. Hubbell
c. Leviton
d. Pass & Seymour

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following]:

a. Cooper
b. Hubbell
c. Leviton
d. Pass & Seymour

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper
b. Hubbell
c. Pass & Seymour
d. Leviton

C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell
b. Pass & Seymour

2.5 USB RECEPTACLES

A. USB Charging Receptacles:

1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
2. USB Receptacles: Dual, one USB Type A and one USB Type C, 5 V dc, and 2.1 A per receptacle (minimum).

3. Standards: Comply with UL 1310 and USB 3.2 Gen 2 devices.

B. Tamper-Resistant Duplex and USB Charging Receptacles Insert drawing designation:

1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
2. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.
3. USB Receptacles: Dual one USB Type A and one USB Type C, 5 V dc, and 2.1 A per receptacle (minimum).
4. Standards: Comply with UL 498, UL 1310, USB 3.2 Gen 2 devices, and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.6 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper
b. Hubbell
c. Leviton
d. Pass & Seymour

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirement provide one of the following:

a. Cooper
b. Hubbell
c. Leviton
d. Pass & Seymour

2. Description:

a. Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
b. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.7 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.8 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Single Pole:
      1) Cooper
      2) Hubbell.
      3) Leviton
      4) Pass & Seymour
   b. Two Pole:
      1) Cooper
      2) Hubbell
      3) Leviton
      4) Pass & Seymour
   c. Three Way:
      1) Cooper
      2) Hubbell
      3) Leviton
      4) Pass & Seymour

C. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper
    b. Hubbell
    c. Leviton
    d. Pass & Seymour

D. Tamper-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper
    b. Hubbell
    c. Pass & Seymour

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.

E. Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper
    b. Hubbell
    c. Leviton
    d. Pass & Seymour

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.

F. GFCI, Feed-Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper
    b. Hubbell
    c. Leviton
    d. Pass & Seymour

G. GFCI, Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper
b. Hubbell
c. Pass & Seymour

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.

H. Toggle Switches, Square Face, 120/277 V, 15 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper
b. Hubbell
c. Leviton
d. Pass & Seymour

I. Lighted Toggle Switches, Square Face, 120 V, 15 A: Comply with NEMA WD 1 and UL 20.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper
b. Hubbell
c. Leviton
d. Pass & Seymour

2. Description: With neon-lighted handle, illuminated when switch is "off."

2.10 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.11 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces 0.035-inch- thick, satin-finished, Type 302 stainless steel

3. Material for Unfinished Spaces: Galvanized
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.12 NONSYSTEM SMOKE DETECTORS

A. General Requirements for Nonsystem Smoke Detectors:

B. Nonsystem smoke detectors shall be listed as compatible with the fire-alarm equipment installed or shall have a contact closure interface listed for the connected load.
1. Nonsystem smoke detectors shall meet the monitoring for integrity requirements in NFPA 72.

C. Single-Station Smoke Detectors:

1. Comply with UL 217; suitable for NFPA 101, residential occupancies; operating at 120-V ac with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device.
2. Auxiliary Relays: One Form C, rated at 0.5 A.
3. Audible Notification Appliance: Piezoelectric sounder rated at 90 dBA at 10 feet according to UL 464.
4. Visible Notification Appliance: 177-cd strobe.
5. Heat sensor, 135 deg F combination rate-of-rise and fixed temperature.
6. Test Switch: Push to test; simulates smoke at rated obscuration.
7. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
8. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
9. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
10. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

2.13 CARBON MONOXIDE DETECTORS

A. Description: Listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Detector shall provide a means to test by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.
4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Detector shall be listed to comply with UL 2075.

6. Detectors shall be located, mounted, and wired according to manufacturer's written instructions.
7. Test button simulates an alarm condition.

2.14 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: White in color unless otherwise indicated or required by NFPA 70 or directed by the architect at the time of shop drawings.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: Orange with orange triangle on face.
5. Receptacles circuited to nLight device PL T24: Gray.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, “Standard Practice for Good Workmanship in Electrical Construction”, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up or down as directed in the field, and on horizontally mounted receptacles to the right or left as directed in the field.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 INSTALLATION OF FIRE DETECTION EQUIPMENT

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to the existing control panel in the existing part of the building.
2. Connect new equipment to the existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement the existing control and monitoring equipment as necessary to extend the existing control and monitoring functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.

C. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
6. Luminaires: Locate detectors not closer than 12 inches from any part of a luminaire and not directly above pendant mounted or indirect lighting.

D. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place, except during system testing. Remove cover prior to system turnover.

E. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a sleeping area, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

3.4 IDENTIFICATION

A. Comply with Section 26 0553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

1. For all other receptacles, provide a clear self-adhesive label with BLACK letters indicating circuit number and panelboard. Example: 4(RP2).

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 26 2726

SECTION 26 2813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, enclosed controllers and motor-control centers.
2. Spare-fuse cabinets.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. Include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70, "National Electrical Code."

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc. / Mersen.
4. Littelfuse, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Motor Branch Circuits: Class RK1, time delay.
2. Other Branch Circuits: Class RK1, time delay.
3. Control Circuits: Class CC, fast acting.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 26 0553 “Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 2813

SECTION 26 2816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Non-fusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section “Closeout Submittals” include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70, “National Electrical Code.”

F. Series rated circuit breakers not acceptable.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric – Basis of Design
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

B. Type HD, Heavy Duty, Single Throw, 600 V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.

4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contract Kit: One N.O./N.C. (Form C) auxiliary contact, arranged to activate before switch blades open.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.2 NON-FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric – Basis of Design
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
4. Auxiliary Contract Kit: One N.O./N.C. (Form C) auxiliary contact, arranged to activate before switch blades open.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D; a brand of Schneider Electric.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
6. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1
2. Outdoor Locations: NEMA 250, Type 4
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 3R
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. All enclosed circuit breakers (400 A and higher) shall be electronic trip unit circuit breakers, and shall have metering.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1, “Standard Practice for Good Workmanship in Electrical Construction.”

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 0553 “Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 26 2816

SECTION 26 2913.03 - MANUAL AND MAGNETIC MOTOR CONTROLLERS

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. Manual motor controllers.
2. Enclosed full-voltage magnetic motor controllers.
3. Combination full-voltage magnetic motor controllers.
4. Enclosures.
5. Accessories.
6. Identification.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. NC: Normally closed.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SCPD: Short-circuit protective device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each type of magnetic controller.

1. Include plans, elevations, sections, and mounting details.
2. Indicate dimensions, weights, required clearances, and location and size of each field connection.

3. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.

4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Product Schedule: List the following for each enclosed controller:

1. Each installed magnetic controller type.

2. NRTL listing.

3. Factory-installed accessories.

4. Nameplate legends.

5. SCCR of integrated unit.

6. For each combination magnetic controller include features, characteristics, ratings, and factory setting of the SCPD and OCPD.

a. Listing document proving Type 2 coordination.

7. For each series-rated combination state the listed integrated short-circuit current (withstand) rating of SCPD and OCPDs by an NRTL acceptable to authorities having jurisdiction.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For magnetic controllers to include in operation and maintenance manuals.

1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:

a. Routine maintenance requirements for magnetic controllers and installed components.

b. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.

c. Manufacturer's written instructions for setting field-adjustable overload relays.

d. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

e. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install temporary electric heating, with at least 50 Wper controller.

1.7 FIELD CONDITIONS

A. Ambient Environment Ratings: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than23 deg F and not exceeding 104 deg F.

2. Altitude: Not exceeding 6600 feet for electromagnetic and manual devices.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.

C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

2.2 MANUAL MOTOR CONTROLLERS

A. Motor-Starting Switches (MSS): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric; or a comparable product by one of the following:

a. Eaton.

b. General Electric Company.

c. Rockwell Automation, Inc.

d. SIEMENS Industry, Inc.; Energy Management Division.

2. Standard: Comply with NEMA ICS 2, general purpose, Class A.

3. Configuration: Nonreversing.
4. Surface mounting as shown on drawings.
5. Red and Green pilot lights.

B. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric; or a comparable product by one of the following:
   a. Eaton.
   b. General Electric Company.
   c. Rockwell Automation, Inc.
   d. SIEMENS Industry, Inc.; Energy Management Division.
2. Configuration: Nonreversing or Two speed to match with mechanical equipment requirement.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button.
4. Pilot Light: Red.

2.3 COMBINATION FULL-VOLTAGE MAGNETIC MOTOR CONTROLLER

A. Description: Factory-assembled, combination full-voltage magnetic motor controller consisting of the controller described in this article, indicated disconnecting means, SCPD and OCPD, in a single enclosure.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric; or a comparable product by one of the following:

1. Eaton.
2. General Electric Company.
3. Rockwell Automation, Inc.
4. SIEMENS Industry, Inc.; Energy Management Division.

C. Standard: Comply with NEMA ICS 2, general purpose, Class A.

D. Configuration: Nonreversing.

E. Contactor Coils: Pressure-encapsulated type with coil transient suppressors when indicated.

1. Operating Voltage: Manufacturer's standard, unless indicated.

F. Control Power:

1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.

a. Spare CPT Capacity as Indicated on Drawings: 50 VA.

G. Overload Relays:

1. Thermal Overload Relays:

a. Inverse-time-current characteristic.

b. Class 10 tripping characteristic.

c. Heaters in each phase shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

d. Ambient compensated.

e. Automatic resetting.

2. Solid-State Overload Relay:

a. Switch or dial selectable for motor-running overload protection.

b. Sensors in each phase.

c. Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

H. Class II ground-fault protection shall comply with UL 1053 to interrupt low-level ground faults. The ground-fault detection system shall include circuitry that will prevent the motor controller from tripping when the fault current exceeds the interrupting capacity of the controller. Equip with start and run delays to prevent nuisance trip on starting, and a trip indicator.

I. Nonfusible Disconnecting Means:

1. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.

2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2.4 ENCLOSURES

A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.

B. The construction of the enclosures shall comply with NEMA ICS 6.

C. Controllers in hazardous (classified) locations shall comply with UL 1203.

2.5 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, except as needed to match enclosure type. Heavy-duty or oil-tight where indicated in the controller schedule.

a. Push Buttons: As indicated in the controller schedule.

b. Pilot Lights: As indicated in the controller schedule.

B. Motor protection relays shall be with solid-state sensing circuit and isolated output contacts for hardwired connections.

1. Phase-failure.

2. Phase-reversal, with bicolor LED to indicate normal and fault conditions. Automatic reset when phase reversal is corrected.

3. Under/overvoltage, operate when the circuit voltage reaches a preset value, and drop out when the operating voltage drops to a level below the preset value. Include adjustable time-delay setting.

C. Breather assemblies, to maintain interior pressure and release condensation in Type 4 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

D. Space heaters, with NC auxiliary contacts, to mitigate condensation in Type 3R enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

E. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

2.6 IDENTIFICATION

A. Controller Nameplates: Laminated acrylic or melamine plastic signs, as described in Section 26 0553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

B. Arc-Flash Warning Labels:

1. Comply with requirements in Section 26 0573.19 "Arc-Flash Hazard Analysis." Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.

2. Comply with requirements in Section 26 0553 "Identification for Electrical Systems." Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis. Labels shall be machine printed, with no field-applied markings.

a. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1) Location designation.

2) Nominal voltage.

3) Flash protection boundary.

4) Hazard risk category.

5) Incident energy.

6) Working distance.

7) Engineering report number, revision number, and issue date.

b. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and space conditions for compliance with requirements for motor controllers, their relationship with the motors, and other conditions affecting performance of the Work.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wall-Mounted Controllers: Install magnetic controllers on walls with tops at uniform height indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 26 0529 "Hangers and Supports for Electrical Systems" unless otherwise indicated.

C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.4 SYSTEM FUNCTION TESTS

A. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.

1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.

2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.

3. Verify the correct operation of sensing devices, alarms, and indicating devices.

B. Motor controller will be considered defective if it does not pass the system function tests and inspections.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain switchgear.

END OF SECTION 26 2913.03

SECTION 26 5151 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior LED lighting fixtures, and lamps.
2. Lighting fixture supports.

B. Related Sections:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 262726 "Wiring Devices" for manual wall-box dimmers.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. LER: Luminaire efficacy rating.

G. Lumen: Measured output of lamp and luminaire, or both.

H. Luminaire: Complete lighting unit, including lamp, reflector, and housing if provided.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.

2. Energy-efficiency data.
3. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
4. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Testing Agency Certified Data: For indicated fixtures, photometric data certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Lamps, installed.
4. Cords and plugs.
5. Pendant support system.

C. Installation instructions.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

B. Product Certificates: For each type of fixtures.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

E. Provide luminaires from a single manufacturer for each luminaire type.

F. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 PERFORMANCE REQUIREMENTS

A. Ambient Temperature: 41 to 104 deg F.

1. Relative Humidity: Zero to 95 percent.

B. Altitude: Sea level to 1000 feet.

C. Listed catalog number is for first named manufacturer. This manufacturer and fixture constitutes the "basis of design". Listing of alternate manufacturer's names does not imply acceptance of their standard product. Manufacturers are responsible for providing fixtures that are equal in all respects to the "basis of design" fixtures. Intent is to allow for competitively bid lighting package, for fixtures with multiple named manufacturers.

1. If the contractor opts to use the fixture of alternate manufacturer, the contractor shall be responsible to provide point-to-point calculations for all areas as directed by the Engineer at the time of shop drawing submission.

D. Substitutions of fixtures only allowed when approved in advance before shop drawings submittal and request for substitution is submitted in accordance with specifications requirements.

2.3 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp type, shape, size, wattage, and coating.
c. CCT and CRI.

2.4 DOWNLIGHT

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper Lighting, an Eaton business.
2. GE Lighting Solutions.
3. OSRAM SYLVANIA.

B. Lamp:

1. Minimum allowable efficacy of 78 lm/W.
2. Rated lamp life of 35,000 hours to L70.
3. Dimmable from 100 percent to 0 percent of maximum light output.
4. Internal driver.
5. User-Replaceable Lamps:

a. Bulb shape complying with ANSI C78.79.
b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum housing and heat sink.
2. Powder-coat or painted finish.
3. Universal mounting bracket.
4. Integral junction box with conduit fittings.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Fixed lens.
2. Medium light distribution.
3. Clear, UV-stabilized acrylic.
4. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
5. Glass: Annealed crystal glass unless otherwise indicated.
6. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

F. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. Recessed luminaires shall comply with NEMA LE 4.

2.5 RECESSED, LINEAR.

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper Lighting, an Eaton business.
2. GE Lighting Solutions.
3. OSRAM SYLVANIA.

B. Lamp:

1. Minimum 4000 lm.
2. Minimum allowable efficacy of 120 lm/W.
3. CRI of minimum 80. CCT of 3500 K.
4. Rated lamp life of 50,000 hours to L90.
5. Dimmable from 100 percent to 0 percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:

    a. Bulb shape complying with ANSI C78.79.
    b. Lamp base complying with ANSI C81.61 or IEC 60061-1.

8. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

C. Housings:

1. Extruded-aluminum housing and heat sink.
2. Powder-coat or painted finish.
3. With integral mounting provisions.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Prismatic acrylic.
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

F. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. NEMA LE 4.

2.6 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A 36/A 36M for carbon structural steel.
2. ASTM A 568/A 568M for sheet steel.

C. Stainless Steel:

1. 1. Manufacturer's standard grade.
2. 2. Manufacturer's standard type, ASTM A 240/240 M.

D. Galvanized Steel: ASTM A 653/A 653M.

E. Aluminum: ASTM B 209.

F. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

2.7 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.8 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires Set level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.

3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Temporary Lighting: If it is necessary, and approved by Architect/Owner, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

F. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

G. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

H. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Wall-Mounted Luminaires:

1. Attached to a minimum 20 gauge backing plate attached to wall structural members.
2. Do not attach luminaires directly to gypsum board.

J. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust aimable luminaires in the presence of Owner’s Representative.

END OF SECTION 26 5151

SECTION 26 5219 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.
4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.

a. Testing Agency Certified Data: For indicated luminaires and signs, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires and signs shall be certified by manufacturer.
b. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Sustainable Design Submittals:

1. Product Data: Indicating luminaire is certified by Design Lights Consortium.
2. Product Data: For lamps, indicating mercury content and lamp life.

D. Product Schedule:

1. For emergency lighting units. Use same designations indicated on Drawings.
2. For exit signs. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Product Certificates: For each type of luminaire.

C. Product Test Reports: For each luminaire for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Luminaire-mounted, emergency battery pack: One for every 20 emergency lighting units. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five year(s) from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Power Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.
2. Warranty Period for Self-Powered Exit Sign Batteries: Two years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.

1. Emergency Connection: Operate one lamp(s) continuously at an output of 1100 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
    b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
    c. Humidity: More than 95 percent (condensing).
    d. Altitude: Exceeding 3300 feet.
4. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

5. Battery: Sealed, maintenance-free, nickel-cadmium type.
6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
7. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit

triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.2 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:

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. Cooper Lighting, an Eaton business.
   b. Lithonia Lighting; Acuity Brands Lighting, Inc.
   c. Philips Lighting Company.

2. Emergency Luminaires: as indicated on Interior Luminaire Schedule Drawings, with the following additional features:

   a. Operating at nominal voltage of 120 V ac.
   b. Internal emergency power unit.
   c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.

3. Manufacturer to match that of normal lighting fixtures in same area. Emergency lighting model to match area lighting fixtures in appearance.

C. Emergency Lighting Unit:

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. Cooper Lighting, an Eaton business.
   b. Dual-Lite.
   c. Lithonia Lighting; Acuity Brands Lighting, Inc.

2. Emergency Lighting Unit: as indicated on Interior Luminaire Schedule Drawings.
3. Operating at nominal voltage of 120 V ac.
4. Wall with universal junction box adaptor.
5. UV stable thermoplastic housing, rated for damp locations.
6. Two LED lamp heads.
7. Internal emergency power unit.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. 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. Cooper Lighting, an Eaton business.
b. Lithonia Lighting; Acuity Brands Lighting, Inc.
c. Philips Lighting Company.

2. Operating at nominal voltage of 120 V ac.
3. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
4. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Tempered Fresnel glass.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
4. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. Extruded aluminum housing and heat sink.
2. Clear anodized finish.

E. Conduit: Electrical metallic tubing, minimum 3/4 inch in diameter.

2.5 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls or attached to a minimum 20-gage backing plate attached to wall structural members or attached using through bolts and backing plates on either side of wall.
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service:

1. Charge emergency power units and batteries minimum of one hour and depress switch to conduct short-duration test.

2. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.

a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 26 5219

SECTION 26 5619 – LED EXTERIOR 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. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.

B. Related Requirements:
   1. Section 26 0923"Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, and occupancy sensors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaire.
   4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
   5. LED Drivers: Include information as to input watts. Indicate mounting distance limitation and standard wire sizes for remote drivers.

6. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.
    a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
    b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
7. Wiring diagrams for power, control, and signal wiring.
8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Sustainable Design Submittals:
1. Product Data: BUG ratings.
2. Product Data: Luminaire calculations. For Light Pollution Reduction for both uplight and light trespass.
3. Product Data: Indicating luminaire is certified by ENERGY STAR and/or Design Lights Consortium.

D. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.

E. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
2. Structural members to which luminaires will be attached.
3. Underground utilities and structures.
4. Existing underground utilities and structures.
5. Above-grade utilities and structures.
6. Existing above-grade utilities and structures.
7. Building features.
8. Vertical and horizontal information.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of the following:
   1. Luminaire.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Source quality-control reports.

F. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
   1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
   2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.9 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including luminaire support components.
      b. Faulty operation of luminaires and accessories.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. UL Compliance: Comply with UL 1598 and listed for wet location.

E. Lamp base complying with ANSI C81.61.

F. Bulb shape complying with ANSI C79.1.

G. CRI of minimum 80 unless otherwise shown on Drawings. CCT of minimum 3000K unless otherwise shown on Drawings.

H. L70 lamp life of minimum 50,000 hours.

I. Lamps dimmable from 100 percent to 0 percent of maximum light output unless otherwise shown on Drawings.

J. Internal driver.

K. Nominal Operating Voltage: 120 V ac or 240 V ac.

L. In-line Fusing: On the primary for each luminaire.

M. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

N. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

O. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

P. Uplight: Exterior lighting shall have maximum luminaire uplight rating of U2 for Lighting Zone 2. Uplight ratings (U) as defined by IESNA TM-15-07 Addendum A.

Q. Light Trespass and Glare: Maximum Glare Rating of G2 and Backlight Rating of B0 or B2 or B3 or B4 based on horizontal distance to lighting boundary (HLB) for Lighting Zone 2. Backlight (B) and Glare (G) ratings as defined by IESNA TM-15-07 Addendum A.

2.2 LUMINAIRE TYPES

A. Refer to lighting fixture schedule on drawings.

B. The manufacturer's fixture catalog numbers specified in the Light Fixture Schedule or as indicated on the drawings, describing the various types of fixtures, do not include all the required accessories or hardware that may be required for a complete installation. Furnish and install a complete complement of Luminaires, as required, and all associated appurtenances including, but not necessarily limited to, all lamps, ballasts, reflectors, pendants, canopies, recessing boxes, plaster frames, brackets etc., completely wired, assembled, installed and tested as specified and in the manner indicated.

2.3 LED DRIVERS

A. LED drivers shall be factory provided by the respective luminaire manufacturers, and shall be suitable for their intended use, to operate the designated LED modules listed in the Luminaire Schedule, and as specified herein, to their full light output.

B. Comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

C. Provide complete connection to LED-type luminaries through both integrally installed and remote electronic drivers.

D. Shall be totally enclosed within a metallic enclosure, and shall be provided with integral leads color coded per ANSI C82.11, or with poke-in style wire retaining connectors.

E. Provide identical drivers within each luminaire type.

F. Provide UL listed and labeled drivers. Provide drivers with temperature ratings appropriate to the installation.

G. Fixtures intended to be dimmed shall have dimming driver compatible with the specified dimmer controls.

2.4 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:
1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:
1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp characteristics:
   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter, shape, size, wattage and coating.
   c. CCT and CRI for all luminaires.

2.5 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
   3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
   4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
      a. Color: Refer to schedule on drawings.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. Do not use permanent luminaires for temporary lighting.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:
   1. Sized and rated for luminaire weight.
   2. Able to maintain luminaire position after cleaning and relamping.
   3. Support luminaires without causing deflection of finished surface.
   4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls.
   2. Attached to a minimum 1/8 inch backing plate attached to wall structural members, where required.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings or as directed by Architect.

I. Coordinate layout and installation of luminaires with other construction.

J. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 0533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 0533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

C. Luminaire will be considered defective if it does not pass tests and inspections.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

END OF SECTION 26 5619

SECTION 31 1000 - SITE CLEARING

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 Department of Public Works Standard Details for Construction dated January 2000 and as amended.

C. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated July, 2021 and as amended.

D. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Stripping and stockpiling rock.
6. Removing below-grade improvements pertains to those items shown on the drawings, and those associated with the above grade improvements to be removed, if they impede the proposed work.
7. Disconnecting, capping or sealing, and removing site utilities and/or abandonment of utilities and appurtenances.
8. Temporary erosion and sedimentation control.

B. Related Requirements:

1. Section 31 2500 for erosion- and sedimentation-control measures.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other non-soil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PROJECT CONDITIONS

A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

1. Protect improvements on adjoining properties and on Owner's property.
2. Restore damaged improvements to their original condition, as acceptable to property owners, in a timely manner and at no additional cost to the Owner.

C. Soil Erosion and Sediment Control: Soil erosion and sediment control measures are required for this site in accordance with the approved plans. Soil erosion and sediment control measures disturbed or damaged by clearing operations shall be restored to operating condition in accordance with the requirements of the approved plan before the end of the work day.

D. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
2. Provide protection for roots over 1-1/2 inch in diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt or other acceptable coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out, cover with earth as soon as possible.
3. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations in manner acceptable to Architect. Employ a licensed arborist to repair damage to trees and shrubs.
4. Replace trees that cannot be replaced and restored to full-growth status, as determined by arborist.

1.5 EXISTING SERVICES

A. General: Indicated locations are approximate, determine exact locations before commencing Work.

B. Arrange and pay for disconnecting, removing, capping, and plugging, utility services. Notify affected utility companies in advance and obtain approval before starting this Work.

C. Place markers to indicated location of disconnected services. Identify service lines and capping locations on Project Record Documents.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.7 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.8 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.9 QUALITY ASSURANCE

A. Comply with standards of authorities having jurisdiction.

B. In the event of a discrepancy between the Project Specifications, Construction Documents, Baltimore County Standard Specifications and Details, or other guidelines set forth by the authorities having jurisdiction, the more stringent will apply.

C. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

D. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.10 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify Miss Utility for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

F. Tree- and Plant-Protection Zones: Protect according to requirements.

G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. The contractor shall review the Construction Managers construction staging plan prior to beginning any construction.

B. Protect and maintain benchmarks and survey control points from disturbance during construction.

C. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements.

D. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. With permission from Erosion & Sediment Control Inspector, remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations.

3.4 EXISTING UTILITIES

A. The contractor will locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. The contractor will coordinate with owner and with approval arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect/Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

D. Abandonment or removal of certain underground pipe or conduits may be indicated on mechanical or electrical drawings and is included under work of related Section 02 4113. Removing abandoned underground piping or conduits interfering with construction shall be as follows:

1. Underground improvements shall be completely removed to a depth of two feet below indicated subgrade under structures and paving or finished grade in other areas or where it conflicts with proposed construction.
2. Pipes and other utilities indicated to be abandoned in place shall have open ends plugged with concrete for a minimum length of one foot. Structures, manholes, and other utility appurtenances shall be filled with compacted subgrade materials.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 12 inches below exposed subgrade.
3. Use only hand methods or air spade for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding 8 inches loose depth, and thoroughly compact each layer to a density not less than 95 percent of the maximum dry density when tested in accordance with AASHTO T-180 within the building footprint and extending out ten feet (10') either side of the exterior wall lines. Beyond this zone, fill may be compacted to a density not less than 92 percent of the maximum dry density when tested in accordance with AASHTO T-180.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 6 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 1 inch in diameter, and without weeds, roots, and other objectionable material.

1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. Remove heavy growths of grass from areas before stripping.

    a. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.

2. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 144 inches or as indicated on the sediment control plans.
2. Do not stockpile topsoil within protection zones.
3. Stockpile surplus topsoil to allow for respreading deeper topsoil.
4. Dispose of unsuitable as specified in Section 31 2300 - Excavating and Filling for disposal of waste material.

3.7 STOCKPILING ROCK

A. Remove from construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.

1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Stockpile rock away from edge of excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.

1. Limit height of rock stockpiles to 144 inches.
2. Do not stockpile rock within protection zones.
3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.

3.8 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.
3. Removal of pavement, including base courses, sidewalk, curb, and combination curb and gutter, shall be for the full depth thereof.
4. The Contractor shall use suitable equipment, tools, and methods for cutting and trimming as well as removing the materials to the neat lines set by the Owner and shall not in any manner disturb or damage the sections of base or pavement to be salvaged.
5. Damage done by the Contractor's equipment or methods to those areas designated for salvaging shall be replaced at the Contractor's expense.

6. Where the old subgrade is satisfactory as to condition and elevation, special care shall be taken in the removal operation in order to avoid the disturbing of the old grade.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property in accordance with local regulations.

B. Burning on Owner's Property: Burning is not permitted on Owner's property.

C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

3.10 RECORD DRAWINGS

A. Survey and include on record drawings location and depth of all utilities encountered which have not been removed.

END OF SECTION 31 1000

SECTION 31 2300 - EXCAVATING, FILLING, AND GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of the Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections apply to all work under this section.

B. All materials and construction methods shall be in accordance with the Baltimore County Department of Public Works Standard Specifications for Construction and Materials, Dated January 2000 and as amended.

C. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated July, 2021 and as amended.

D. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Engineer for consideration. Those judged to be equal to that specified will receive written approval.

1.2 DESCRIPTION SUMMARY

A. This Section includes the following:

1. Backfilling operation to bring the existing site to grade.
2. Preparing and grading sub grades to slabs-on-grade, walks, pavements, turf and grass, and exterior plants (landscaping).
3. Excavating and backfilling for buildings and structures.
4. Drainage and moisture-control fill course for slabs-on-grade.
5. Subbase course for walks and pavements.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches within building lines.
8. Excavating and backfilling for underground utilities and appurtenances.

B. Related Sections:

1. Section 31 1000: Site Clearing
2. Section 32 9000: Planting
3. Section 03 3300: Cast-in-Place Concrete

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation:

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and surface pavement in a paving system.

C. Bedding course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe

D. Borrow Soil: Satisfactory soil material imported from off-site when sufficient approved soil material is not available from on-site excavations.

E. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevation and to lines and dimensions indicated, and the reuse or disposal of materials removed.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Engineer. Authorized additional excavation and replacement will be paid for according to the Contract provisions for changes in Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer shall be at the Contractor's expense.
4. Additional excavation: When excavation has reached required subgrade elevations, the contractor will notify the independent testing agency who will make an inspection of conditions and submit inspection report for review and approval of the Engineer (authority having jurisdiction). The Contractor is responsible to attain the independent testing agency (Inspection Agency) and coordinate the scheduling of the inspections such that there is no delay in the Project. If the Inspection Agency determines that bearing material at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by them. The Inspection Agency shall also provide the services of a professional Geotechnical Engineer licensed in the State of Maryland, to provide evaluations and recommendations during the course of excavation and filling.
5. An independent testing agency, acceptable to Authorities having Jurisdiction.

G. Fill: Soil materials used to raise existing grades.

H. Recycled Material: Recycled Material shall contain a minimum of 90% post-consumer material.

I. Rock Excavation in Trench Excavation and Pits, including continuous wall footings and individual column footings, shall consist of:

1. The removal of/and disposal of solid rock, ledge rock, rock hard cementitious materials and/or boulders ½ cubic yards or more in volume in trench excavations less than 10 feet in width and pits less than 30 feet in either length or width.
2. Excavation of materials that required the use of:

    a. Excavating equipment which exceeds standard Earth Excavating Equipment as defined herein.
    b. Systematic drilling.
    c. Hand-held or backhoe mounted pneumatic hammers
    d. Blasting.

3. Blasting will only be permitted after receiving permission from the Engineer and local authorities. The Contractor shall obtain special liability insurance to protect all parties, including the Engineer from all claims resulting from any blasting.

J. Rock Excavation in open excavation (all excavations other than trench excavation and pit excavation) shall consist of the following:

1. The removal and disposal of solid rock, ledge rock, rock hard cementitious material and/or boulders 2 cubic yards or more in volume.
2. Excavation of materials that requires the use of:

    a. Excavation equipment which exceeds standard Earth Excavation Equipment as defined herein.
    b. Systematic drilling.
    c. Hand-held or backhoe mounted pneumatic hammers.

3. Blasting will not be permitted.

K. The Contractor is advised that minimum standard earth excavation equipment is defined as follows:

1. For Trench Excavation as defined herein: 250 H.P., track mounted, hydraulic excavator with a 3-foot rock bucket.
2. For Open Excavation as defined herein: 280 H.P. crawler dozer with a single shank ripper.

L. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

M. Subbase Course: The layer between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk

N. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

O. Utilities include on-site underground pipes, conduits, ducts, and cable, as well as underground services within building lines.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for the following:

1. Each type of warning tape.
2. Filter fabric and geotextiles.
3. Recycled materials.
4. Requirements for local material source.

C. Test Reports: In addition to test reports required under field quality control, submit the following:

1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources, including classification per ASTM D2487.
2. One moisture density curve for each soil material, per AASHTO T-180.
3. Reports of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.
4. All support of excavation submittals must be accompanied by working drawings and design calculations. The drawings and calculations must be signed and sealed by a professional engineer licensed in the State of Maryland.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork complying with requirements of Authorities having Jurisdiction.

B. Testing and Inspection Agency Service: The Contractor will employ a qualified independent Professional Geotechnical Engineering and testing agency registered in the state of Maryland to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing during earthwork operations and to check bearing capacities of excavated footings to confirm required bearing capacity prior to installation of reinforcing steel and concrete. The Geotechnical Engineer will be available during footing excavation and backfilling to review conditions and provide recommendations as needed. All testing and reports shall be provided at no additional cost to the Engineer and Owner.

C. Pre-excavation Conference: Before commencing earthwork, meet with representatives of the governing authorities and the Engineer at Project site. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

1.6 PROJECT CONDITIONS

A. Backfilling below-grade areas: The backfilling operation required to bring actual grades to the grade elevations shown on the drawings as existing grades.

1. The borrow material shall be removed and then either stored or disposed. If the testing agency verifies that the borrow material complies with these specifications for backfill material, then the Contractor may use it to backfill this area to grade.
2. Any additional backfill material necessary to complete this operation shall comply with these specifications.

B. Site Information: Data from the existing building drawings was used for the basis of the design. Conditions are not intended as representations or warranties of accuracy. The Engineer, or Engineers will not be responsible for interpretations or conclusions drawn from this data by the Contractor. It is assumed the subsurface conditions allowing the current existing wall to be built will be suitable for the construction of the proposed wall.

C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Engineer and then only after acceptable temporary utility services have been provided. If existing utilities are indicated to be abandoned, the Contractor shall remove such utility, if necessary, at no additional cost to the Owner.

1. Provide a minimum 48-hours-notice to the Engineer and receive written notice to proceed before interrupting any utility.

D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.

E. Should uncharted or incorrectly charted, piping or other utilities be encountered during excavation, consult Utility Engineer immediately for directions. Cooperate with Engineer and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of Utility Engineer.

F. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Open excavation within the roadways shall be plated and shall be posted with warning devices in accordance with the Manual of Uniform Traffic Control Devices.

1. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

2. Work which affects the public right-of-way shall be in accordance with the Baltimore County requirements and regulations.

G. Moisture Sensitive Soils:

1. The on-site founding materials are moisture sensitive and will be easily disturbed by excessive construction activity.
2. The exposed founding materials shall be protected against detrimental changes in engineering qualities as a result of disturbance from rain or frost.
3. Surface runoff shall be drained away from the excavations and not allowed to pond.
4. If possible, concrete shall be placed in the footings the same day the excavations are made, or the founding materials may be covered by mud mats in order to protect the founding soil from becoming saturated due to forecasted precipitation and/or disturbed due to excessive construction activity during the placement of steel reinforcement.
5. The presence of moisture sensitive fine-grained soils poses the potential for high moisture content. Soils may be found to be at or near their plastic limit; consequently, the on-site soils may require discing, aeration, and/or manipulation to achieve efficient compaction.
6. Any regions exhibiting poor drainage characteristics, and low lying areas, shall be expected to display moisture contents which are excessively high for normal earthwork operations.
7. Any standing water shall be drained or pumped into approved sediment control facilities prior to commencement of earthwork.
8. Excavations near to subgrade and all fills should be protected from traffic of heavy equipment, including heavy compaction equipment, when on-site soils exhibit high moisture contents, in order to minimize pumping and a generalized deterioration of these materials.

H. The Contractor is solely responsible for the protection of the sub-grade until it receives final surface treatment and shall maintain the sub-grade as suitable and acceptable to the Geotechnical Engineer. He shall be completely responsible for restoration or replacement of the sub-grade due to moisture damage, construction traffic, or any other cause. Repair or replacement of the sub-grade shall be performed at no additional cost to the Engineer.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations. Classification of materials shall be made by the Contractors independent testing agency.

1. Provide subbase and backfill manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

B. Satisfactory Soil Materials: ASTM D 2487 soil classified as SM , SC, SP, GM, GC, and GP and having a liquid limit less than 35 and a plasticity index less than 20; free of rock or gravel large than 4 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. However, materials used as backfill behind below-grade walls or retaining walls should have classifications of Sandy SILT (ML), or more granular, in accordance with ASTM D 2487, and should have at least 30 percent by weight of soil particles retained on the No. 200 sieve. Based on the construction of the existing retaining wall, the majority of the on-site material may be usable as structural fill, provided that its moisture content is within +/-2 percent of the optimum moisture content.

C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups CL, MH, CH, OL, OH, and PT.

D. Backfill and Fill Materials: Satisfactory soil materials.

E. Subbase and Base Material: naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, ASTM D 2940. Graded aggregate for subbase courses shall meet the requirements for G A S/B as shown in Table 312300-1. Recycled concrete (RC-6) is not permitted.

Table 312300-1

SIEVES		**MASS PERCENT PASSING**	
Mm	**Standard**	**BRG S/B**	**G A S/B**
100	**4 in.**		
90	**3.5 in.**		
63	**2.5 in.**	**100**	

Table 312300-1

SIEVES		MASS PERCENT PASSING	
50	2 in.		100, ± 3
37.5	1.5 in.		90 - 100, ± 5
25	1 in.	90 - 100	
19	¾ in.		
12.5	½ in.	60 - 100	
9.5	3/8 in.		
4.75	#4		30 - 60, ± 10
2.36	#8		
2.0	#10	35 - 90	
0.60	#30		

Table 312300-1

SIEVES		**MASS PERCENT PASSING**	
0.425	**#40**	**20 - 55**	
0.075	**#200**	**5 - 25**	**0 - 12, ± 5**

F. Engineered Fill: Subbase or base materials

G. Bank Run Gravel for subbases: Bank Run Gravel for subbase courses shall meet the requirements for BRG S/B as shown in Table 312300-1.

H. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, AASHTO M43, coarse aggregate grading size 57, with 100 percent passing a 1 inch sieve and not more than 5 percent passing a No. 8 sieve.

I. Filtering Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100 percent passing a 1inch sieve and 0 to 5 percent passing a No. 50 sieve.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

K. Regional Materials: Provide aggregate and sand products manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep.

1. Tape Colors: Provide tape colors to utilities as follows:

a. Red Electric
b. Yellow: Gas, oil, steam, and dangerous materials

c. Orange: Telephone and other communications
d. Blue: Water Systems
e. Green: Sewer Systems

B. Filter Fabric: Manufacturer's standard nonwoven previous geotextile fabric of polypropylene, nylon, or polyester fibers, or a combination.

1. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D4759 and the referenced standard test method in parentheses:

a. Grab Tensile Strength (ASTM D 4362): 100lb.
b. Apparent Opening Size (ASTM D 4751): #100 U.S. Standard sieve.
c. Permeability (ASTM 4491): 150 gallons per minute per sq. ft.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:

1. Portland Cement: ASTM C 150, Type I Type II or Type III.
2. Fly Ash: ASTM C 618, Class C or F.
3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
4. Foaming Agent: ASTM C 869.
5. Water: ASTM C 94.
6. Air-Entraining Admixture: ASTM C 260.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Tree protection is specified in the Division 31 Section 31 1000 - "Site Clearing."

3.2 DEWATERING

A. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding project site and surrounding area.

B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

C. All pumped water shall be disposed of as approved by the authority having jurisdiction. and comply with local codes and ordinances. Provide and maintain pumps, well points, and sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

D. Provide adequate pumps, well points, and other equipment, appurtenances, power, drains, material, and labor necessary to do all pumping needed to keep the excavations, pits, trenches, and all spaces included in the area of the building dry during the casting of mats, footings, slabs, and walls, and at such other times as the progress of the work may demand.

E. During excavation and placing of mats, footings, slabs, and walls, ground water shall be maintained a minimum of one foot below the levels of their bottoms. The dewatering system shall maintain such levels until the backfilling is completed and the removal of the dewatering equipment will not cause or endanger any construction, as determined by the Engineer.

F. The dewatering system shall also be adequate to remove storm water from the excavations and prevent accumulation of surface water within the construction area.

3.3 BACKFILLING BELOW-GRADE AREAS

A. Completely fill below-grade areas and void resulting from the demolition of the site improvements and pavements with compacted fill, as described below, to the grades as shown as existing grades on the drawings.

1. Use satisfactory soil materials, as defined by ASTM D 2487, consisting of SM , SC, SP, GM, GC, and GP having a liquid limit less than 35 and a plasticity index less than 20; free of rock or gravel large than 4 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. However, materials used as backfill behind below-grade walls or retaining walls should have classifications of Sandy SILT (ML), or more granular, in accordance with ASTM D 2487, and should have at least 30 percent by weight of soil particles retained on the No. 200 sieve.
2. Prior to placement of compacted structural fill, the fill subgrade should be stripped of organic layers and then proof rolled under the observation of the Engineers Testing Agency. A minimum 20-ton dump truck should be used for proof rolling if necessary. Areas of subgrade that exhibit pumping or contain organic material should be removed down to firm, natural soils. Any additional loose or unsuitable soils found should be removed and replaced with compacted fill.

3. Place fill materials in horizontal layers not exceeding 8 inches in loose depth. Compact each layer to a density not less than 95% of the maximum dry density when tested in accordance with ASTM D-1557, Modified Proctor. In building and pavement areas, the top 12 inches of fill should be compacted to 95% of the maximum density when tested in accordance with ASTM D-1557, Modified Proctor. Fill materials should be placed at moisture contents within +2 points of the optimum moisture content. No compacted fill shall be placed unless a soils technician is present to monitor fill compaction.
4. Based on existing conditions, it is expected that on-site soils should generally be suitable to be used as structural fill, however; moisture conditioning may be required for excavated soils to achieve a workable range of moisture contents for compaction. All soils used as backfill within the Critical Zone behind retaining walls should have USCS classifications of Sandy SILT (ML) or more granular and minimum angle of internal friction of 28 degrees when compacted to a minimum of 95% of its maximum dry density per ASTM D698. Any existing soils not meeting these criteria should be removed from the Critical Zone of the walls, as determined by the geotechnical engineer at the time of construction. When SM soils are encountered, they should be set aside to be reused as wall backfill. Unsatisfactory fill materials include materials which do not satisfy the requirements for suitable materials, as well as topsoil and organic materials (OH, OL), elastic Silt (MH), and high plasticity Clay (CH).

B. Testing Agency shall verify compliance of borrow material at both the in-situ location and after the material has been brought to the site.

3.4 EXCAVATION

A. Explosives: Do not use explosives.

B. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.

3.5 STABILITY OF EXCAVATIONS

A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

B. Slope sides of excavation to comply with local codes, ordinances, and requirements of authorities having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

3.6 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within tolerance of plus or minus ½ inches. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspection.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Appurtenances: Excavate to elevations and dimensions indicated within a tolerance of plus or minus ½ inches. Do not disturb bottom of excavations intended for bearing surface.

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevation and grades.

3.8 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated slopes, lines, depths, and invert elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe conduit, unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels, of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.

1. For pipes or conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bells of loads and ensure continuous bearing of pipe barrel on bearing surface.

3.9 UNAUTHORIZED EXCAVATION

A. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.

B. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by the Geotechnical Engineer.

3.10 APPROVAL OF SUBGRADE

A. Notify Geotechnical Engineer / Testing Agency when excavations have reached required subgrade.

B. When Geotechnical Engineer / Testing Agency determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Geotechnical Engineer / Testing Agency.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade including, where applicable, damp-proofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for record documents.
3. Testing, inspecting, and approval of underground utilities.
4. Concrete formwork removal.

5. Removal of trash and debris from excavation.
6. Removal of temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Backfill operations adjacent to existing building shall be performed with caution in order to protect existing building foundation walls. Backfill operations shall not be performed adjacent to proposed retaining wall until the concrete has achieved a minimum of 3,000 psi compressive strength, and the passage of 3 days since the last wall pour. Compaction shall be performed using hand equipment without large vibratory equipment.

3.13 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on unyielding bearing surface and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches of footings. Place concrete to level of 4 inches above bottom of footings.

C. Provide 4 inch thick concrete base slab support for piping or conduit less than 30 inches below surface of roadways. After installation and testing, completely encase piping or conduit in a minimum 4 inches of concrete before backfilling or placing roadway subbase.

D. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles large than 1 inch, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact material under pipe haunches and bring backfill evenly up to both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

E. Coordinate backfilling with utilities testing.

F. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.

G. Place and compact final backfill of satisfactory soil material to final subgrade.

H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.14 BUILDING SLAB DRAINAGE COURSE

A. General: Drainage course consists of placement of drainage fill material, in layers of indicated thickness, over subgrade surface to support concrete building slabs.

B. Placing: Place drainage fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

1. Provide minimum 4 inches of drainage fill below all slabs. Drainage fill shall be an evenly graded mixture of natural or crushed gravel or crushed stone and natural sand with 95-100 percent passing a 1 inch sieve and less than 12 percent passing a No. 200 sieve. Place in a single layer and compact to a minimum of 95 percent of the maximum dry density, as determined by the Modified Proctor compaction test method ASTM D 1557. Overlay fill with vapor barrier below all slabs.

3.15 SUBSURFACE DRAINAGE BACKFILL

A. Subsurface Drain: Place a layer of filter fabric around perimeter of drainage trench or at footing, as indicated. Place a 6 inch compacted course of filtering material on filter fabric to support drainage pipe. After installing and testing, encase drainage pipe in a minimum of 6 inches of compacted filtering material and wrap in filter fabric, overlapping edges at least 6 inches.

B. Impervious Fill: Place and compact impervious fill material for top 6" to final subgrade.

3.16 FILL

A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstruction, and deleterious materials from ground surface prior to placing fills.

1. Plow strip, or break up sloped surface steeper than 1 vertical 4 horizontal so fill material will bond with existing surface. Compact all surfaces with proper equipment to avoid vibration and damage to existing building foundations.

B. When subgrade or existing ground surface to receive fill has density less than required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and re-compact to required density.

C. Place fill material in layers to required elevations for each location listed below.

1. Under grass, use satisfactory excavated or borrow soil material.
2. Under walks, pavements, and footings use subbase or base material, or satisfactory excavated or borrow soil material.
3. Under piping and conduit and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder.

3.17 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.

    a. Stockpile or spread and dry removed wet satisfactory soil material.

3.18 COMPACTION

A. Place backfill and fill 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. All compaction performed between retaining wall and existing building wall shall be done with non-vibratory hand operated equipment.

B. Place backfill and fill materials evenly on all sides of structures to required elevations to prevent wedging action. Place backfill and fill uniformly along the full length of each structure.

C. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Geotechnical Engineer / Testing Agency if soil density tests indicate inadequate compaction.

D. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D-1557 (Modified Proctor):

1. Under structures, building slabs, steps, compact the top 12 inches of fill materials below subgrade to 95 percent maximum density. Each layer of backfill or fill material below the top 12 inches should be compacted to 90 percent maximum dry density.
2. Under pavement, compact the top 12 inches of fill materials below subgrade to 95 percent maximum density. Each layer of backfill or fill material below the top 12 inches should be compacted to 90 percent maximum dry density.
3. Under walkways, compact the top 6 inches below subgrade and each layer of backfill or fill material at 90 percent maximum density.
4. Under lawn or unpaved areas, compact the top 6 inches below subgrade and each layer of backfill or fill material at 85 percent maximum density.

E. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

3.19 GRADING

A. General: Uniformly grade areas to a smooth surface free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between existing adjacent grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1/2 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.20 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements.

1. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of ASTM D 4254 relative density.
2. Shape subbase and base to required crown elevations and cross-slope grades.
3. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
4. When thickness of compacted subbase or base course exceed 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

B. Pavement Shoulders: Place shoulder along edges of subbase and base course to prevent lateral movement. Construct shoulders at least 12 inches wide of acceptable soil materials and compact simultaneously with each subbase and base layer.

3.21 DRAINAGE FILL

A. Under slabs-on-grade, place drainage fill course on prepared subgrade.

1. Compact drainage fill to required cross sections and thickness,
2. When compacted thickness of drainage fill is 6 inches or less, place materials in a single layer.

3. When compacted thickness of drainage exceeds 6 inches thick place materials in equal layers, with no layer more than 6 inches thick nor less than 3 inches thick when compacted.

3.22 FIELD QUALITY CONTROL

A. Testing Agency Service: Engage qualified independent testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements that shall be reviewed and approved by the Geotechnical Engineer.

1. Perform field-in-place density tests according to ASTM D 1556 (sand cone method).

    a. Field-in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.
    b. When field-in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each difference type of material encountered, and at intervals as directed by the Geotechnical Engineer / Testing Agency.

2. Footing Subgrade: Inspect bearing state at each column footing and at twenty foot intervals in wall footings, at the footing subgrade, to verify required bearing capacity.
3. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 500 sq. ft. or less of paved areas or building slab, but in no case fewer than three tests.
4. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 30 feet or less of wall length, but no fewer than two tests along a wall face.
5. Trench Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 50 feet or less of trench, but no fewer than two tests.

B. When qualified independent testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained. Testing will be paid by the Contractor at no additional cost to the Engineer.

3.23 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Use extreme care and caution when backfilling between structural walls. Backfilling shall be done in a manner as not to induce excessive loads, not produce impacts, and not produce vibrations that can be detrimental to the structures.

C. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Geotechnical Engineer / Testing Agency; reshape and re-compact at optimum moisture content to the required density.

D.. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

2. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.24 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Contractor shall remove and dispose of offsite all excess topsoil and/or borrow remaining after final grading has been completed.

1. Remove waste material, including unsatisfactory soil trash, debris, and legally dispose of off the Owner's property.

END OF SECTION

SECTION 31 2500 – SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Sediment and Stormwater Administration, Maryland Department of the Environment, Stormwater Management and Erosion and Sediment Control Guidelines for State and Federal Projects dated, Feb. 2015, and addenda thereto.

C. Baltimore County Department of Public Works Standard Details for Construction dated January 2000 and as amended.

D. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated July, 2021 and as amended.

1.2 SUMMARY

A. The extent of soil erosion and sediment control facilities is shown on the Erosion and Sediment Control Plans, approved by the Baltimore County Soil Conservation District.

B. The contractor will assume responsibility for the erosion and sediment controls that currently exist on the site at the time the contract is executed, and will be responsible for the conversion of the erosion and sediment controls from their existing state to those outlined in the construction documents. Additionally, the contractor will also be responsible for all erosion and sediment controls outlined within the contract documents and/or any additional erosion and sediment controls required by the inspector at no additional cost to the Owner.

1.3 QUALITY ASSURANCE

A. Comply with local codes where applicable and to the requirements of all permits.

B. Comply with the provisions outlined in Division 1.

PART 2 - PRODUCTS

2.1 MATERIALS REQUIREMENTS

A. Material requirements are specified on the drawings.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of the soil erosion and sediment control facilities shall be as shown and specified on the Sediment/Erosion Control Plans and Detail sheets of the Contract Drawings.

3.2 TIMING

A. All perimeter control shall be installed and approved by the Sediment Control Inspector as specified in the “Sequence of Construction” on the Contract Drawings.

3.3 MAINTENANCE

A. All soil erosion and sediment control measures shall be maintained continuously during the construction period.

B. Soil erosion and sediment control measures shall be inspected daily, and any measure which has been disturbed or damaged shall be repaired and restored to operating condition in accordance with the approved plan before the end of each work day at no additional cost to the Owner.

3.4 REMOVAL

A. Soil erosion and sediment control measures shall not be removed until the removal has been authorized by the Sediment Control Inspector.

END OF SECTION

SECTION 32 1313 - CONCRETE PAVING

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 Department of Public Works Standard Details for Construction dated February 2000 and as amended.

C. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated July 2021 and as amended.

D. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

1.2 SUMMARY

A. Section Includes Concrete Paving, Including the Following:

1. Driveways.
2. Roadways.
3. Parking lots.
4. Curbs and gutters.
5. Walks.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
2. Section 31 2300 "Excavating, Filling and Grading".

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

C. Damaged section of C&G, S/W, inlet throat, or driveway/utility apron: Any typical section of Curb & Gutter (10 l.f.), or sidewalk, that contains a combination of three or fewer chips, gouges, or other forms of damage, will be considered for patching. Any section(s) containing more than three areas of damage or chipping will be removed and replaced. Inlet throats and driveway/utility aprons will be judged as outlined in this as well as in subsequent paragraphs, as applicable.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete paving Subcontractor.
e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specifications Sections.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

C. Qualification Data: For qualified Installer of stamped detectable warnings, ready-mix concrete manufacturer, and testing agency.

D. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificate shall be assigned by manufacturer and Contractor certifying that each material item complies with or exceed requirements. Provide certification from admixture manufacturers that chloride content complies with requirements

1. Material Certificates: For the following, from manufacturer:

a. Cementitious materials.
b. Steel reinforcement and reinforcement accessories.
c. Fiber reinforcement.
d. Admixtures.
e. Curing compounds.
f. Applied finish materials.
g. Bonding agent or epoxy adhesive.
h. Joint fillers.

E. Material Test Reports: For each of the following:

1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

F. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

C. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

D. Concrete Testing Service: The Contractor will engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

1. The contractor shall provide the Testing Agency a minimum of 24 hours notice prior to the performance of such testing required.

E. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

F. Repair / Replacement Policy:

1. Only those permits or projects that have less than ten (10%) percent of damaged curb and gutter (C&G) sections, will be considered for repair rather than replacement. (Eligibility for repair is covered in subsequent paragraphs.) If the ten percent rule is exceeded, the repair option is forfeit and all damaged section of C&G on the job will be removed and replaced. Example: a street permit of 800 linear feet (1600' of C&G) would be allowed to have a maximum of 160 feet of damaged C&G. At 10 feet per average block, this would equal sixteen sections. (Damage is defined in Section 1.3)
2. The same formula (percentage of linear feet) would apply against sidewalk (S/W), though naturally the blocks or sections would be based on the four (4) or five (5) foot sections as applicable. Inlet throats and driveway/utility aprons will not be a consideration in the eligibility requirements
3. The maximum allowable chip, gouge, etc., will be six (6") inches in the longest dimension. Any defect(s) larger than six inches will be considered as a non-repairable defect, and the entire block, section, or other subject structure will be slated for removal and replacement. (Note: if damage to only half of a driveway apron has occurred, only the damaged half need to be replaced by methods outlined in Paragraph 6. Chips or other slight imperfections of less than one and one-half (1 ½") inches in the longest dimension will not be considered as detrimental and therefore will not be a factor. The depth of the damaged area is not to be considered in the evaluation. In the same vein, the presence of structural integrity, or lack thereof, in a specific piece of concrete will not be a basis for judgement or discussion. This premise would include all types of and/or sizes of defects or damages.
4. When a permit/project does qualify for repair, the areas to be patched shall meet the following criteria:

    a. The patch has to blend in with the original or surrounding area of concrete in color and texture, as well as conform to the adjoining area in configuration (shape). Since some products undergo color changes during the curing process, time will be granted for color matching based on the specific product manufacturer's performance data.

b. The areas repaired will be subjected to a durability test and have to meet with the inspector's satisfaction. The test for durability and adhesion will be conducted by a moderate blow with a 16 oz. hammer.
c. Any deviation or failure of any portion(s) of the above listed requirements will be cause for automatic rejection of the repair process. The resulting alternative will be to remove and replace all damaged sections on the permit/project in question

5. The following examples of damage will not be considered for repair but will fall under the guidelines as sections to be removed and replaced.

   a. Any evident cracks (including hairline) that permeate the exposed surface area(s) of the structure. (Inlet throats are exempt - see 5d.)
   b. Any areas of the finished concrete exhibiting signs of spalling.
   c. Curb and gutter or sidewalk sections damaged by long scars, six (6") inches or more in length, that are deep enough to expose the aggregate.
   d. Cracks in inlet throats will be allowed (based on the additional strength afforded by the use of steel reinforcement), provided the cracks are only hairline in nature and not differential and only occur at either, or both ends (wall areas), of the inlet.

6. In some cases, where damage has occurred to two adjoining pieces of C&G (if both on their merits would be subject to replacement) the removal and replacement of the damaged portions of each section would be acceptable, provided the new section of the damaged portions of each section will still meet the five foot minimum, thirteen foot maximum block requirement. The joints at the damaged areas would be required to be cut with a concrete saw and the defective portions removed and replaced without further damage to the adjoining concrete.
7. The following example of damage is not included in, or constrained by, the previously detailed guidelines:

   a. When the section(s) of C&G are damaged on the vertical face of the gutter pan (rolling of base asphalt, grading, etc.), the following criteria will apply:

      1) The loss of concrete shall not exceed one-half (½") inch, as measured horizontally from the edge of the gutter where it meets the asphalt, toward the face of the curb.
      2) In this case, the otherwise acceptable section(s) shall be treated in the following manner:

         a) The damaged area(s) must be thoroughly cleaned and coated with an epoxy sealer.
         b) Upon completion of the 2" bituminous concrete surface course, the longitudinal joint formed by the asphalt and the gutter pan at the damaged section(s) must be sealed with bituminous asphalt joint sealer.
      3) When the loss of concrete exceeds the one-half (½") inch dimension previously mentioned, the damaged sections must be removed and replaced.

G. In the event of a discrepancy between the Project Specifications, Construction Documents, Baltimore County Standard Specifications and Details, or other guidelines set forth by the authorities having jurisdiction the more stringent will apply.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.9 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feetor less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from galvanized-steel wire into flat sheets.

B. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.

C. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A767/A767M, Class I coating. Cut bars true to length with ends square and free of burrs.

D. Epoxy-Coated, Joint Dowel Bars: ASTM A775/A775M; with ASTM A615/A615M, Grade 60plain-steel bars.

E. Tie Bars: ASTM A615/A615M, Grade 60; deformed.

F. Hook Bolts: ASTM A307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

H. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

I. Zinc Repair Material: ASTM A780/A780M.

2.4 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150/C150M, white portland cement Type I.

a. Use one brand of cement throughout project unless otherwise acceptable to Architect.
b. Mix shall be in accordance with the Portland Association publication #IS174.02T "Concrete for Small Jobs".
c. All concrete shall be 3000 psi (MDSHA mix no.2), air-entrained (5% ± 1%) and the proportions by volume shall be in accordance with Table 321300-1.
d. Contractor shall furnish to the Owner delivery tickets for the concrete at the time of delivery.

TABLE 321300-1
PROPORTIONS BY VOLUME

Maximum Size Coarse Aggregate	Cement	Sand	Aggregate	Water
3/8"	1	2 ¼"	1 ½"	½"
½"	1	2 ¼"	2	½"
¾"	1	2 ¼"	2 ½"	½"
1"	1	2 ¼"	2 ¾"	½"
1 ½"	1	2 ¼"	3	½"

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 4S, uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1 ½ inches nominal.
2. Do not use fine or coarse aggregates that contain substances that cause spalling.
3. Local aggregates not complying with ASTM C33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.

C. Air-Entraining Admixture: ASTM C260/C260M. Subject to compliance with requirements, provide one of the following:

1. Air-Tite or Amex 210; Cormix Construction Chemicals.
2. Air-Mix or Perma-Air; Euclid Chemical Co.
3. Darex AEA or Daravair; W.R. Grace & Co.
4. MB-VR or Micro-Air, Master Builders, Inc.
5. Sealtight AEA; W.R. Meadows, Inc.
6. Sika AER; Sika Corp.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A. Subject to compliance with requirements, provide one of the following:

a. Chemtard; ChemMasters Corp.
b. Type A Services; Cormix Construction Chemicals.
c. Eucon WR-75; Euclid Chemical Co.
d. WRDA; W.R. Grace & Co.
e. Pozzolith Normal or Polyheed; Master Builders, Inc.
f. Metco W.R.; Metalcrete Industries.
g. Plastocrete 161; Sika Corp.

2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

E. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. Color: As selected by Architect from manufacturer's full range.

F. Water: Potable and complying with ASTM C94/C94M.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Liquid Membrane-Forming Curing Compound: AASHTO M-148. Products: Subject to compliance with requirements, provide one of the following:

1. Clear Cure; Anti-Hydro Co., Inc.
2. Spartan-Cote; The Burke Co.
3. All Resin; Conspec Marketing & Mfg. Co.
4. Sealco 309; Cormix Construction Chemicals
5. Day-Chem Cure and Seal; Dayton Superior Corp.
6. Diamond Clear; Euclid Chemical Corp.
7. #64 Resin Cure-Clear; Lambert Corp.
8. L&M Cure R; L&M Construction Chemicals
9. Masterkure; Master Builders, Inc.
10. 3100 Series; W.R. Meadows, Inc.
11. Seal N Kure; Metalcare Industries
12. Kure-N-Seal; Sonneborn-Chemrex
13. Horn Clear Seal; Tamms/A.C. Horn

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber ASTM D1752, cork or self-expanding cork or ASTM D8139, semirigid, closed-cell polypropylene foam in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene. Subject to compliance with requirements, provide one of the following:

1. Acrylic Bondcrete; the Burke Co.
2. Strongbond; Conspec Marketing and Mfg. Co.
3. Day-Chem Ad Bond (J-40); Dayton Superior Corp.
4. SBR Latex; Euclid Chemical Co.
5. Daraweld C; W.R. Grace & Co.
6. Everbond; L&M Construction Chemicals, Inc.
7. Acryl-Set; Master Builders, Inc.
8. Intralok; W.R Meadows, Inc.
9. Acrylpave; Metalcare Industries.
10. Sonocrete, Sonneborn-Chemrex
11. Stonlok LB2; Stonhard, Inc.
12. Strong Bond; Symons Corp.

D. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
2. Epoxy-Bonding Adhesive: Subject to compliance with requirements, provide one of the following:

a. Burke Epoxy M.V.; the Burke Co.
b. Spec-Bond 100; Conspec Marketing and Mfg. Co.
c. Resi-Bond (J-58); Dayton Superior.
d. Euco-Epoxy System #452 or #620; Euclid Chemical Co.
e. Concresive Standard Liquid; Master Builders, Inc.
f. Rezi-Weld 1000; W.R. Meadows, Inc.
g. Metco Hi-Mod Epoxy; Metalcrete Industries.
h. Sikadur 32 Hi-Mod; Sika Corp.
i. R-6000 Series; Symons Corp.
j. Epoxtite Binder 2390; Tamms/A.C. Horn, Inc

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method. Do not use the Owner's field quality-control testing agency as the independent testing agency.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. This project requires Md SHA Mix #3, 3500 psi concrete mix.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content, 1-1/2-inchNominal Maximum Aggregate Size: 5-1/2 percent plus or minus 1-1/2 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to [0.15] [0.30] percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete as required for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

G. Concrete Mixtures: Normal-weight concrete.

1. Md SHA Mix #3, 3500 psi.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

1. Top of Forms: Not more than ½ inch in 10 feet.
2. Vertical Face on Longitudinal Axis: Not more than ½ inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.4 INSTALLATION OF STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints:

1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with key, unless indicated otherwise. Embed keys at least 1 ½ inches into concrete.
2. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
3. Provide tie bars at sides of paving strips where indicated.
4. Use bonding agent one existing concrete surfaces that will be joined with fresh concrete.
5. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
6. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inchesinto concrete.
7. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 25 feet for sidewalks and 40 feet for curb and gutter, unless indicated otherwise.
2. Extend joint fillers full width and depth of joint, not less than ½ inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inchradius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

    a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. Inserts: Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris

3. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

    a. Tolerance: Ensure that sawed joints are within 3 incheseither way from centers of dowels.

4. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

F. Walks shall be constructed to match existing concrete.

1. Expansion joints between building and pavement shall be bituminous fiber type.
2. Expansion joints shall be installed between existing concrete pavement and new pavement.
3. Pavements shall be separated from curbs by a construction joint using felt roofing paper material.
4. "Vinylex Waterstop Cap Strip" control joint to be installed at a maximum of 25' and between existing walks and new concrete.
5. Saw cut control joints are not permitted.
6. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one half of dowel length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

1. When concrete placing is interrupted for more than ½ hour, place a construction joint.

G. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

H. Consolidate concrete according to ACI 301by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

I. Screed paving surface with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

J. Place concrete in two operations; strike off initial pour for entire width of placement and to the required finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agency if acceptable to Architect.

K. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

L. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutter to required cross section, lines, grade, finish and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

M. Slip-Form Paving: When automatic machine placement is used for paving, submit revised mix design and laboratory test results that meet or exceed requirements. Produce paving to required thickness, lines, grades, finish, and jointing as required for formed paving.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

N. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

O. Cold Weather Placement: Comply with provision of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50° F and not more than 80° F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agent or chemical accelerators unless otherwise accepted in mix designs.

P. Hot Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90° F. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperation immediately before embedding in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft sport, or dry areas.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inchdeep with a stiff-bristled broom, perpendicular to line of traffic.

C. Final Tooling: Tool edges of paving, gutter, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

1. Radius: 3/8 inch

3.8 INSTALLATION OF DETECTABLE WARNINGS

A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Section 321726 "Tactile Warning Surfacing."

1. Tolerance for Opening Size: Plus 1/4 inchno minus.

B. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles specified in Section 321726 "Tactile Warning Surfacing." Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with Section 321726 "Tactile Warning Surfacing" immediately after screeding concrete surface.

C. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.

1. Before using stamp mats, verify that the vent holes are unobstructed.
2. Apply liquid release agent to the concrete surface and the stamp mat.
3. Stamping: While initially finished concrete is plastic, accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
4. Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.
5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x hbefore and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover, curing curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inchlap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed ¼ inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 20 cu. yd.or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
6. Compressive-Strength Tests: ASTM C39/C39Mone set for each day's pour of each concrete class exceeding 5 cu. yd. But less than 25 cu. yd., plus one set for each additional 50 cu. yd. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.

C. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

D. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operation and provide corrective procedures for protecting and curing the in-place concrete.

E. Strength of each concrete mixture will be satisfactory if 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.

F. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

G. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

H. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

I. Concrete paving will be considered defective if it does not pass tests and inspections.

J. Additional testing and inspecting: The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

K. Prepare test and inspection reports.

3.12 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 1313

SECTION 32 9200 - TURF AND GRASSES

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 Department of Public Works Standard Details for Construction dated February 2000 and as amended.

C. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated July 2021 and as amended.

D. 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, and as amended.

E. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Landscape Architect for consideration and the Owner for approval. Those judged to be equal to that specified will receive written approval unless otherwise noted within these specifications.

1.2 SUMMARY

A. Section Includes:

1. Seeding.
2. Hydroseeding.
3. Sodding.
4. Plugging.
5. Sprigging.
6. Meadow grasses and wildflowers.
7. Turf renovation.
8. Erosion-control materials.
9. Grass-paving materials.

B. Related Requirements:

1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
2. Section 31 2300 "Excavating Filling and Grading".

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct a conference at the Project site to comply with the requirements of Division 1 Section "Project Meetings" prior to installation of turfgrass materials.

1.5 INFORMATIONAL SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Qualification Data: For Landscape Installer.

C. Product certificates signed by manufacturers certifying that their products comply with specified and the Laws and regulations of both the United States Department of Agriculture and the Maryland State Department of Agriculture requirements. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Manufacturer's certified analysis for standard products.
2. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
3. Soil testing shall be by a recognized laboratory utilizing USDA standards and certified by the North American Proficiency Testing requirements.

4. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of the supplier.

D. Grass seed mixtures shall be Maryland Interagency Certified Mixtures or Maryland State Highway Permanent Mixture certified and supervised by the Maryland Department of Agriculture/Turf and Seed Section, properly tagged with analysis tags and Maryland Interagency Certification tags or Maryland State Highway Administration tags sewn directly into the closing stitch of each bag of seed. All seed must comply with the Federal Seed Act, and the Maryland Seed Law and their associated regulations. NO SUBSTITUTIONS WILL BE PERMITTED.

1. Analysis labeling shall include: Name of mixture, lot number assigned to identify the mixture, pure seed and germination percentages of each component listed by the kind and variety of each component greater than five (5) percent, other crop seed percentage found in the mixture, inert matter percentage found in the mixture, weed seed percentage found in the mixture, declaration that mixture is "free of all undesirable grass and noxious weed seeds", the test date of the mixture, and the name and address of the company making these claims.
2. Maryland Interagency Certification tag shall include: The name of the mixture, the lot number to identify the mixture, the date the mixture was completed, and the company where the mixing occurred. The tag shall be Blue.
3. Maryland State Highway Administration Permanent Mixtures tag shall include: The name of the mixture, the lot number to identify the mixture, the date the mixture was completed, the company where the mixing occurred and a "Used By" date. The tag shall be Orange.
4. Each bag of seed shall be properly tagged with both the analysis and certification tags sewn into the closing stitch of the bag. Both tags for each bag utilized shall be submitted in quantities sufficient for the area seeded.

E. Turfgrass Sod shall be Maryland Certified Tall Fescue Sod produced in Maryland and certified by the Maryland Department of Agriculture/Turf and Seed Section. All labeling must comply with the Maryland Turfgrass Law and regulations. NO SUBSTITUTIONS WILL BE PERMITTED.

1. Each load of turfgrass sod must be labeled to include: The kind of sod, the date sod was harvested, the quantity of sod delivered, the county and state where it was grown, the producers name and address.

    a. All sod shall be delivered to the site in a freshly harvested condition.
    b. All sod shall be uniformly harvested to a uniform thickness and size of the pads or rolls.
    c. All sod shall be harvested from the same grower and farm unless approved by the Owners Representative.
    d. All torn pads shall be rejected.
    e. Sod shall not be harvested, delivered, or installed when either excessively wet or excessively dry.
    f. Sodding installation shall not be attempted if air temperatures are more than 85 degrees Fahrenheit.
    g. Each load of sod shall be labeled to reflect the quantity on each load.
    h. All sod labels shall be submitted to the Owner's Representative.

i. Deficient quantities of sod represented on the delivery tickets shall be compared to the drawings to insure proper quantities

2. A Maryland State Certification label must be attached to each delivery ticket.
3. Delivery tickets must be submitted in quantities sufficient for area sodded.

F. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names, and address of architects, CMs and owners, and other information specified.

G. Planting schedule indicating anticipated dates and locations for each type of planting. Planting schedule shall also include a construction plan.

H. Turfgrass Installer shall provide a listing of similar projects they have completed including:

1. Location of all such projects.
2. Dates when project occurred including the completion date.
3. Contact information of the owner and CM for which the project was completed.

I. Product Certificates: For fertilizers, from manufacturer.

J. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member of the Landscape Contractors Association MD DC VA.
2. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in all the following categories from the National Association of Landscape Professionals:

a. Landscape Industry Certified Technician - Exterior.
b. Landscape Industry Certified Lawn Care Manager.

c. Landscape Industry Certified Lawn Care Technician.

5. Inspection: The Owner may inspect the seed or sod either at the place of mixing or growth or at the site before planting. Inspection will be for, but not limited to, compliance with requirements for genus, species, variety, size, and quality. The Owner retains the right to inspect the seed or sod for root systems, insects, weeds, disease, harvesting, and transportation defects and reserves the right to reject unsatisfactory or defective material at any time during the progress of work. Rejected seed or sod shall be removed immediately from the project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers identifying the product, showing the net weight, analysis, and name of manufacturer. Protect materials from moisture, deterioration, or other damage during delivery and while stored at site.

B. Seed: Deliver seed in original sealed, labeled, and undamaged new bags. Any bags which are ripped, torn, wet, rodent damaged or otherwise damaged shall be rejected and must be removed immediately from the project site. Do NOT store seed in metal containers if excessive heat is present or forecasted. Temperatures above 120 degrees Fahrenheit can significantly damage germination.

C. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying. Sod shall only be trimmed with a straight blade. Torn edges or patches smaller than 6" x 6" will not be acceptable.

D. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways, and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.9 COORDINATION AND SCHEDULING of Turfgrass Seeding and Sodding

A. Coordinate installation of seed and sod during normal planting seasons as stated within 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, and as amended.

B. Athletic fields shall be constructed during the earliest phases of the construction, after installation of sediment controls, to allow turf grasses the maximum time to mature.

1.10 FIELD CONDITIONS

A. Existing Conditions: Notify the Owner's Representative and hire a private utility locating service to, locate, verify, and mark/flag the location of all underground utilities prior to planting operations.

B. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. For Planting periods, refer to 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, and as amended.

D. Excavation: When conditions that are detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Architect and Owner's Representative and correct before planting.

E. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1. Do not seed or sod when soil is excessively wet or dry.
2. Do not seed if soil temperatures are less than 55 degrees Fahrenheit.
3. Do not seed if air temperatures are 90 degrees Fahrenheit or above.
4. Do not sod if air temperatures are 85 degrees Fahrenheit or above.
5. Fertilizer containing Nitrogen (N) or Phosphorus (P) shall not be applied between Nov.16 and March 1.

F. Coordination with Landscaping: Plant seed and/or sod after finish grades are established and trees, shrubs and other non-turf planting material has been installed or otherwise acceptable to the Owner's Representative.

1. When planting trees and shrubs after lawns, protect landscape areas and promptly repair damage caused to the seeding or sodding operations as per Section 3.6 "Reconditioning Lawns".

1.11 COORDINATION AND SCHEDULING of Turfgrass Seeding and Sodding

A. Coordinate installation of seed and sod during normal planting seasons (see Section 3.1 "Planting Seasons") for each type.

B. Athletic fields shall be constructed during the earliest phases of the construction, after installation of sediment controls, to allow turf grasses the maximum time to mature.

1.12 WARRANTY of Turfgrass Seeding and Sodding

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Warrant the following living planting materials for a period of one year after inspection by the Owner and Engineer and written acceptance of work by the Owner. Defects resulting in abnormal weather conditions unusual for warranty period, or incidents beyond the contractor's control are not covered by this warranty provided ALL requirements of this contract have been met. The Owners acceptance of the building does not constitute acceptance of the turfgrass or change any warranty or maintenance periods.

1. Seeding:

   a. The Contractor shall warrant and begin establishment maintenance immediately after seeding installation.
   b. The Contractor shall continue warranty and establishment maintenance until such time as the seeding provides a minimum of 95% coverage and free of visible weeds/insects or disease damage.
   c. The Contractor shall re-seed, fertilize, and apply weed, insect and disease controls, mow, and water as many times and as long as necessary to reach the 95% turfgrass coverage for acceptance by the Owner.
   d. Once Contractor receives acceptance of obtaining 95% coverage of turf by the Owner's Representative, a warranty and maintenance of the turfgrass period begins for no less than one (1) additional year.
   e. At the end of the one (1) year maintenance period the Contractor may requests in writing of the Owner an "acceptance inspection" provided 95% turfgrass coverage remains.

2. Sodding:

   a. The Contractor shall notify the Owner once the sodding is complete. The Contractor shall request and acceptance inspection 10 working days after the final installation. The contractor will be responsible for watering and general maintenance until substantial completion has been achieved. Any defects will be corrected without cost to the owner.
   b. After substantial completion and after acceptance by the Owner, the Contractor will warrant the sod for no less than six (6) months to no more than one (1) year provided the sod has been installed prior to an entire growing cycle May 1 to Oct. 30.

3. If seeded and sodded turfgrass occur on the same site, the maintenance period continues for both until such time as BOTH seeded and sodded areas receive final acceptance.

4. Sodding may be substituted for any turfgrass seeding at any time if Contractor wishes to accept shorter warranty and maintenance periods.

1.13 MAINTENANCE and WORK ACCEPTANCE - Turfgrass Seeding and Sodding

A. General Turfgrass: Begin maintenance of turfgrass areas immediately after each area is planted and continue after written initial acceptance of the work until final acceptance is awarded as defined below.

B. Continue maintenance and establishment of all turfgrass areas by following a sound maintenance plan to include but not be limited to watering, fertilizing, weeding, mowing, trimming applying pesticides as necessary and other operations. Bare spots which exist after three (3) weeks of favorable growing weather shall be re-cultivated, reseeded, raked, and rolled as specified in Section 3.2. Soil Preparation" Mulching shall be with clean barley or wheat straw. Reseeding of bare spots shall be done as many times as necessary to establish a final acceptance of 95% coverage as determined by the Owner.

C. Contractor shall keep on site a diary of procedures applied to the turfgrass from the day installed until final acceptance by the Owner. This diary shall include dates, applications, rates, the weather on the day of application and who did the application.

1. Diary shall be on site anytime work is being accomplished.
2. Diary shall be made available to Owner's Representative upon verbal request
3. Failure to provide or maintain diary will be cause to stop work and/or remove contractor from site.

D. Turfgrass areas designated as "Sodded" must be sodded with Maryland Certified Tall Fescue Sod.

E. Turfgrass areas designated as "Seeded" may be seeded with the 95-5 Maryland Interagency Certified Grass Seed Mixture or the 95-5 Maryland State Highway Administration Permanent Seed Mixture specified OR the Contractor may, with the Owner's approval, sod all Turfgrass areas.

F. Seeded Turfgrass - Maintenance shall include but not be limited to:

1. 60 days after initial seeding the Owner's Representative shall do a "work acceptance" inspection to verify that all work has initially been complete satisfactorily. This shall include:

a. Verifying a uniform healthy stand of seedling turfgrass with:

1) Good color
2) Uniform color
3) Uniform seedling distribution - 4 to 5 grass plants / square inch
4) Minor weed presence - no dodder, dock or other weed which smother desirable turfgrasses.

5) Soil under turf to be smooth and safe to walk or play on

b. Verifying a uniform and proper soils preparation under the turfgrass.

1) Probed cores of soil shall be taken to verify that ALL soil preparation including but not limited to: removing all debris, loosening subsoil, proper depth of screened top soil, uniform blending of top soil with sub soil to create a transition zone, the addition of organic matter as needed, and the incorporation of other needed amendments.
2) The owner reserves the right to have these soil cores tested for organic matter, nutrients, and pH to verify all amendments have been added.
3) If test indicate amendments were properly added the Owner shall bear the cost of testing.
4) If test indicates that any of the amendments are not compliant with specifications, then the Contractor shall bear the cost of the testing and will correct all issues even if it requires the entire area to be destroyed and started over again.

c. Verifying all debris and excess materials has been removed. Any residue on buildings, driveways, sidewalks, and existing landscaping and turfgrass has been cleaned and or repaired to initial condition.

2. If work fails to be accepted, complete all necessary corrections and an additional "work acceptance" inspection shall take place after an additional 60 days.'This may be repeated twice.
3. If after 180 days from the initial seeding and the contactor has not shown that he can successfully repair or replace the deficient issues to make the work acceptable, the Contractor shall at his expense destroy the vegetation present, properly re-work the soil, and sod all the turfgrass area(s) involved.
4. If after the three (3) inspections (180 days) and the Contractor has not successfully corrected all deficiencies with properly installed turfgrass sod, the Owner reserves the right to bring another Contractor in to make the necessary corrections and the cost shall be the responsibility of the initial Contractor who was awarded the contract.
5. Once the work acceptance inspection is positive the Contractor shall maintain all seeded turfgrass areas for a period of no less than one (1) year. After that time a "Final Acceptance" inspection shall be requested in writing by the Contractor at least 10 days in advance and the inspection will be scheduled and conducted by the owner:

a. Verifying a uniform healthy stand of seeded turfgrass with:

1) Good color
2) Uniform color
3) Uniform seedling distribution - 4 to 5 grass plants / square inch
4) 95% of the soil surface must be covered with turfgrass plants. The composition should be 3-4 tall fescue plants and 1-2 Kentucky bluegrass per square inch.
5) Turfgrass is weed free
6) Turfgrass is free of any visible insect damage

7) Turfgrass is free of any visible disease damage
8) Soil under turf has remained safe to walk or play on
9) Soil has not settled improperly.
10) Review diary to verify that all maintenance application have been applied at the correct rates and proper timing.

G. Sodded Turfgrass- Maintenance shall include but not be limited to:

1. 10 days after initial sodding the Owner's Representative shall do a "work acceptance" inspection to verify that all work has initially been completed satisfactorily. This shall include:

a. Verifying a uniform healthy stand of mature sodded turfgrass with:

1) Good uniform color
2) Tightly butted joints with no gaps or open areas
3) Good healthy roots are extending into the topsoil
4) Soil under turfgrass sod to be smooth and safe to walk or play on
5) Proper drainage with no puddling 2-3 hours after irrigation or rain

b. Verifying a uniform and proper soils preparation under the turfgrass.

1) Probed cores of soil shall be taken to verify that ALL soil preparation including but not limited to: removing all debris, loosening subsoil, proper depth of screened top soil, uniform blending of top soil with sub soil to create a transition zone, the addition of organic matter as needed, and the incorporation of other needed amendments.
2) The owner reserves the right to have these soil cores tested for organic matter, nutrients, and pH to verify all amendments have been added.
3) If test indicate amendments were properly added the Owner shall bear the cost of testing.
4) If test indicate that any of the amendments are not compliant with the specifications, then the Contractor shall bear the cost of the testing and will correct all issues even if it requires the entire area to be destroyed and started over again.

2. If work fails to be accepted, complete all necessary corrections and an additional "work acceptance" inspection shall take place after an additional 10 days. This may be repeated twice if necessary.
3. If after three (3) inspections (30 days) the Contractor has not successfully corrected all deficiencies the Owner reserves the right to bring another Contractor in to make the necessary corrections and the cost shall be the responsibility of the initial Contractor who was awarded the contract.

4. Once the "work acceptance" inspection is complete, the Contractor shall maintain the sodded turfgrass for no less than six (6) months to no more than one (1) year. The final inspection must be requested in writing to the Owner provided the sod was installed prior to an entire growing cycle May 1 to Oct. 30.or a period of 1 year has passed since work acceptance. The inspection will look for:

    a. Verifying a uniform healthy stand of seeded turfgrass with:

        1) Good uniform color
        2) Turfgrass is weed free
        3) Turfgrass is free of any visible insect damage
        4) Turfgrass is free of any visible disease damage
        5) Soil under turf has remained safe to walk or play on
        6) Soil has not settled improperly.
        7) Review diary to verify that all maintenance application have been applied at the correct rates and proper timing.

1.14 MAINTENANCE OF SEEDED TURFGRASS: - TURFGRASS SEEDING AND SODDING

A. Begin maintenance immediately after each area is seeded and continue until the turfgrass is accepted at the "final inspection".

B. These maintenance requirements are not all inclusive. Other measures may need to be added if an unforeseen issue arises. These additional measures may be handled with the Contractors expertise but they must be approved by the Owner. All additional expense for maintenance corrective measures, equipment or employment of specialists shall be the responsibility of the Contractor at no additional expense to the Owner.

C. Maintain seeded turfgrass areas by watering, liming, fertilizing, applying Apex-10, controlling weeds, insects and turfgrass diseases, mowing, trimming and other operations for healthy turf. Bare spots which exist after three (3) weeks of favorable growing weather shall be repaired by raking or loosening the soil, seeding at the prescribed seeding rate with the specified seed, rolling and mulching with straw mulch as specified under establishment Part 3 "Execution". Reseeding of bare spots shall be done as many times as necessary to establish 95% coverage of desirable plants as determined by the Owner.

D. Watering: Provide and maintain all temporary piping, hoses, and turfgrass watering equipment necessary to convey water from water sources to the soil surface to keep the turfgrass uniformly moist to a depth of 4 inches.

E. NOTE - Watering Recommendations: An exact watering schedule is impossible due to the variability of the air temperature, wind speed, rains, and other uncontrollable factors. Therefore, utilize the following as guidelines. In the end YOU are responsible for over watering or under watering. Ultimately 1" of water is desired per week of "Maintenance" from either "Mother Nature" or applied by Contractor. However, OVER WATERING MAY BE AS DETRIMENTAL OR MORE DETRIMENTAL TO TURFGRASS THAN INSUFICIENT QUANTITIES. Both are detrimental to quality turf so extreme attention to watering is recommended.

1. **Watering Seeded Aeas:

    a. Install seed by dry-seeding or hydro-seeding as specs require
    b. Roll all areas where it is practical to insure good soil to seed contact
    c. Lightly water the seed. Water as much as possible but not so much as the water "runs" or moves seed. Mist or light shower nozzles are a plus.
    d. Water lightly at least every day for two to three weeks. Multiple times a day may be required if temperatures dictate it. The idea is to keep the seed moist to encourage germination.
    e. Once seedlings appear (Usually 7-10 days you will begin to see green hairs) continue watering but increase the water amount slightly.
    f. Once grass plants begin producing a second leaf start monitoring watering by utilizing rain gauges or similar devices which can be visible or monitored outside the watering area in a method approved by CCPS to indicate quantity of water applied, but only fill approximately ½ inch every day for a week.
    g. REMOVE methods of measurement AFTER EACH WATERING and PLACE AGAIN FOR NEXT WATERING or damage to the turf will result.
    h. The next week water every other day which should be approximately ¾ to 1 inch
    i. The next week water every other day
    j. The following week water every third day
    k. Finally water once a week as weather permits.
    l. Anytime turf is too wet to walk on do not water.
    m. Anytime turf looks dry (blue/gray color) water.
    n. Anytime turf "crunches" under foot or leaves foot prints as walking across, water

F. Mow lawns as soon as there is enough top growth to cut with mower. Never allow the grass to get taller than 3.75-4 inches tall before being mowed back to 2.5 inches tall. Never mow shorter than 2.5 inches. Repeat mowing as required to maintain specified height without removing more than 30 percent of the grass leaf blade (height) at any single mowing.

1. Do not delay mowing until grass blades bend over and become matted.
2. If turf should exceed 4 inches due to weather conditions. Remove 1/3 of the plant blades, return to mow again in 2 days. Continue until mowing height returns to 2.5 inches. Excessive leaf clippings must be vacuumed or raked off of turf and properly disposed off site.
3. Do not mow when grass is wet.

4. Do not mow if possible when temperature is above 85 degrees F and absolutely no mowing at 90 degrees F or above. If mowing occurs at temperatures above 85 degrees F, or above, irrigate immediately after mowing.
5. Any "windrows" or clumps of cut grass must be removed and disposed of properly off site and at the Contractors expense.
6. Only well maintained mowers with sharp blades with all safety equipment in place shall be used.
7. All line trimmers must have all standard safety equipment in place and used.
8. Any oil, gasoline, diesel or other petroleum products leaked or spilled on the turfgrass will result in an area being excavated twice as wide as the spill area in all directions and twice as deep as spill material can be found in the soil. Excavated soil shall be disposed of as hazardous material per the Laws and Regulations under the Maryland Department of the Environment. New fresh topsoil shall be added and the turfgrass re-established. All associated cost are the responsibility solely of the Contractor.

G. Apex-10 - Is Peat derived Humic Acid with naturally derived Polyhydroxy Carboxylic Acids

1. Apply 3 oz. / 1000 sq. ft. in a minimum of 4.5 to 5 gal of water 30 days after planting Turfgrass Seed.
2. At each Fertilizer application apply 3 oz./1000 sq. ft. in a minimum of 4.5 to 5 gal of water
3. Water in after each application.
4. Apex-10 can be mixed with insecticides, fungicides, and pre-emergent herbicides. DO NOT mix with or apply within 2 weeks of post-emergent herbicides.
5. Apex-10 can be applied through a hydroseeder
6. Apex-10 is a unique product and as such NO SUBSTITUTIONS are available or will be permitted.
7. Newsom Seed Co, Fulton MD is the Mid-Atlantic Distributor of Apex-10 (800-553-2719)

H. Post-fertilization: Apply fertilizer following the recommendations based on the soils tests results of the top soil. Recommendations must be developed by converting laboratory findings to Maryland FIV figures and then determine what is needed for optimum turfgrass growth following the University of Maryland recommendations and complying with the Maryland Nutrient Management Law and the Maryland Fertilizer Applicator Law and their regulations. The recommendations should be prepared by a Professional Turfgrass Agronomist or similar individual familiar with Maryland's unique growing challenges.

1. During the fall apply in three (3) applications which will provide a total of 0.9 lbs. of actual nitrogen per 1,000 sq.ft. per each application. Fertilizer shall be granular form. A minimum of 20% of the nitrogen supplied must be in the form of slow release sources.
2. A cosmetic fertilizer application shall be made in mid- May of 0.5 lbs. per 1,000 s.f. of slow release nitrogen.
3. For turfgrass areas which DO NOT need to be overseeded in the Spring: Apply pre-emergent herbicide for crabgrass control the following spring between April 1st through 15th

a. Dependent upon product either apply a spring application of pre-emerge herbicide and follow that with an application of post emergent crabgrass control in early July as needed. Or apply a split pre-emergent application in spring and early July with a follow-up application of post emergent crabgrass control in late July if needed.
b. Apply post emergent broadleaf weed control as needed between May 15th and June 15th.

4. For seeded area which need to be overseeded in the Spring: Overseed as early in the Spring as possible following proper soil preparation and utilizing the seed specified in these specifications.

a. Apply an application of post emergent crabgrass control in late June to early July as needed.
b. Apply post emergent broadleaf weed control as needed between May 15th and June 15th.

5. All pesticide applications must be coordinated with and approved by the CCPS Office of Environmental Issues Program.

a. IPM laws of CCPS and IPM laws for Maryland Schools must be followed.
b. Only chemicals from the approved CCPS list can be utilized
c. No pesticide applications shall be permitted while students are on the premises

1.15 MAINTENANCE OF SODDED TURFGRASS: - TURFGRASS SEEDING AND SODDING

A. Begin maintenance immediately after each area is sodded and continue until the turfgrass is accepted at the "final inspection".

B. These maintenance requirements are not all inclusive. Other measures may need to be added if an unforeseen issue arises. These additional measures may be handled with the Contractors expertise after being approved by the Owner. All additional expense for maintenance corrective measures, equipment or employment of specialists shall be the responsibility of the Contractor at no additional expense to the Owner.

C. Maintain sodded turfgrass areas by watering, liming, fertilizing, applying Apex-10, controlling weeds, insects and turfgrass diseases, mowing, trimming and other operations necessary for a healthy turf.

D. Weak damaged turf shall be removed, tilled, raked, and re-sodded. This shall include sod which is allowed to shrink before rooting and allowing gaps to develop between individual sod pads. Re-sodding shall be done as many times as necessary to maintain 95% coverage of desirable plants as determined by the Owner.

E. Watering: Provide and maintain all temporary piping, hoses, and turfgrass-watering equipment to convey water from water sources to the soil surface to keep the turfgrass uniformly moist to a depth of 4 inches

F. NOTE - Watering Recommendations: An exact watering schedule is impossible due to the variability of the air temperature, wind speed, rains, and other uncontrollable factors. Therefore, utilize these as guidelines. Ultimately 1" of water is desired per week of "Maintenance" from either "mother Nature" or applied by Contractor. However, OVER WATERING MAY BE AS DETRIMENTAL OR MORE DETRIMENTAL TO TURFGRASS THAN INSUFICIENT QUANTITIES. Both are detrimental to quality turf so extreme attention to watering is recommended:

1. *Watering Sodded Areas:
2. Water soil slightly (not to produce mud) if soil is excessively dry (fluffy) or excessively hot. Let moisture dry before installing (so it does not clump on your feet)
3. Install sod using a brick pattern to stagger joints and break up water flow.

    a. Start next to building, sidewalk or other straight area with a full sod pad (roll)
    b. DO NOT walk on freshly laid sod
    c. Start second row with a half pad (roll)
    d. Ensure there are no open joints between sod pads

4. Roll sod as one area is completed to insure good sod to soil contact without air pockets.
5. Water as soon as one area is complete

    a. Sod allowed to dry will shrink and not return to full pad size leaving cracks for weeds to germinate and the sod to be rejected

6. Apply ¾ to 1 inch of water at each and every watering except the first week.
7. For the first week after installation, water daily. Apply ¾ to 1 inch at installation and ½ inch of water at each and every watering.
8. 2nd week, water every other day, go to ¾ to 1 inch each and every time for all additional waterings.
9. 3rd week, water every third day
10. 4th week, water once a week

    a. Anytime sod is too wet to walk on do not water.
    b. Anytime sod looks dry (blue/gray color) water.
    c. Anytime sod "crunches" under foot or leaves foot prints as walking across, water

G. Mow lawns as soon as there is enough top growth to cut with mower. Never allow the grass to get taller than 3.75-4 inches tall before being mowed back to 2.5 inches tall. Never mow shorter than 2.5 inches. Repeat mowing as required to maintain specified height without removing more than 30 percent of the grass leaf blade (height) at any single mowing.

1. Do not delay mowing until grass blades bend over and become matted.
2. If turf should exceed 4 inches due to weather conditions. Remove 1/3 of the plant blades, return to mow again in 2 days. Continue until mowing height returns to 2.5 inches. Excessive leaf clippings must be vacuumed or raked off of turf and properly disposed of off-site.

3. Do not mow when grass is wet.
4. Do not mow if possible when temperature is above 85 degrees F and absolutely no mowing at 90 degrees F or above. If mowing occurs at temperatures above 85 degrees F, or above, irrigate immediately after mowing.
5. Any "windrows" or clumps of cut grass clippings must be removed and disposed of properly off site and at the Contractors expense.
6. Only well maintained mowers with sharp blades with all safety equipment in place shall be used.
7. All line trimmers must have all standard safety equipment in place and used
8. Any oil, gasoline, diesel or other petroleum products leaked or spilled on the turfgrass will result in an area being excavated twice as wide as the spill area in all directions and twice as deep as spill material can be found in the soil. Excavated soil shall be disposed of as hazardous material per the Laws and Regulations under the Maryland Department of the Environment. New fresh topsoil shall be added and the turfgrass re-established. All associated cost are the responsibility solely of the Contractor.

H. Apex-10 - Is Peat derived Humic Acid with naturally derived Polyhydroxy Carboxylic Acids

1. Apply 3 oz. / 1000 sq. ft. in a minimum of 4.5 to 5 gal of water immediately after installing the Turfgrass Sod.
2. Apply 3 oz. /1000 sq. ft. in a minimum of 4, 5 to 5 gal of water 30 days after the installation of the sod.
3. At each Fertilizer application, apply 3 oz./1000 sq. ft. in a minimum of 4.5 to 5 gal of water
4. Water in after each application.
5. Apex-10 can be mixed with insecticides, fungicides, and pre-emergent herbicides. DO NOT mix with or apply within 2 weeks of post-emergent herbicides.
6. Apex-10 can be applied though a hydroseeder
7. Apex-10 is a unique product and as such NO SUBSTITUTIONS are available or will be permitted.
8. Newsom Seed Co, Fulton MD is the Mid-Atlantic Distributor of Apex-10 (800-553-2719)

I. Post-fertilization: Apply fertilizer to sodded turfgrass 30 days after installation of the seed or sod and when grass is dry.

1. Apply fertilizer following the recommendations based on the soils tests results of the top soil. Recommendations must be developed by converting laboratory findings to Maryland FIV figures and then determine what is needed for optimum turfgrass growth following the University of Maryland recommendations and complying with the Maryland Nutrient Management Law and the Maryland Fertilizer Applicator Law and their regulations. The recommendations should be prepared by a Professional Turfgrass Agronomist or similar individual familiar with Maryland's unique growing challenges.
2. During the fall apply in three (3) applications which will provide a total of 0.9 lbs. of actual nitrogen per 1,000 sq.ft. per each application. Fertilizer shall be granular form. A minimum of 20% of the nitrogen supplied must be in the form of slow release sources.
3. A cosmetic fertilizer application shall be made in mid- May of 0.5 lbs. per 1,000 s.f. of slow release nitrogen.

4. For turfgrass areas which are health and a tight knit turf with no soil exposed, pre-emergent herbicides will not need be applied

    a. Apply post emergent crabgrass control in late June to early July if needed.
    b. Apply post emergent broadleaf weed control as needed between May 15th and June 15th.

5. Sodded areas should not need to be overseeded in the Spring. If they do: Overseed as early in the Spring as possible following proper soil preparation and utilizing the seed specified in these specifications.

    a. Apply an application of post emergent crabgrass control in late June to early July as needed.
    b. Apply post emergent broadleaf weed control as needed between May 15th and June 15th

6. All pesticide applications must be coordinated with and approved by the CCPS Office of Environmental Issues Program.

    a. IPM laws of CCPS and IPM laws for Maryland Schools must be followed.
    b. Only chemicals from the approved CCPS list can be utilized
    c. No pesticide applications shall be permitted while students are on the premises

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Grass Seed: Maryland Interagency Certified Mixture or Maryland State Highway Administration Permanent Mixture, fresh, clean, dry, properly labeled seed fully complying with the Federal Seed Act, the Maryland Seed Law and regulations and the Maryland Interagency Certified Seed Mixing regulations.

    a. All seed must comply with the regulations and requirements standards for seed "eligible for Maryland Certified Turfgrass Sod Production" or Maryland State Highway Permanent Seeding.
    b. All seed shall have been tested within 6 months of certified mixing and utilized on this site within 9 months of testing. Seed to be utilized beyond the 9 months "Test Date" shall have new germination tests performed by the Maryland Seed Laboratory, Annapolis, MD (410)-841-5960 before the seed can be used.

c. Seed shall only be sampled and tested by the Maryland Department of Agriculture/Turf and Seed Section/Seed Laboratory, 50 Harry S Truman Parkway, Annapolis, MD 21401 (410)-841-5960. NO SUBSTITUTIONS will be permitted.

d. All varieties must be chosen from the latest University of Maryland, "Recommended Turfgrass Cultivars" (TT #77).

1) Seed mixture should contain at least two (2) tall fescue certified varieties from TT #77.

2) Seed Mixture shall contain one (1) Kentucky bluegrass variety from TT #77.

GRASS SEED MIXTURE for CCPS

Species Certified Turf-Type	% by Weight	Min. % of Purity	Min. % of Germination
Tall Fescue (Festuca arundinacea)	95%	98%	90%
Certified Kentucky Bluegrass (Poa pratensis)	5%	98%	85%

e. All seed shall be mixed and labeled under the direct supervision of the Maryland Department of Agriculture/Turf and Seed Inspectors

2.2 TURFGRASS SOD

A. Turfgrass Sod: Certified, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted. All sod shall be Maryland Certified Tall Fescue Sod.

1. Sod shall be machine cut to a uniform soil thickness of ½ inch, plus or minus ¼ inch. Measurement shall exclude top plant growth and thatch.
2. Mowing height of harvested sod shall be no taller than three (3) inches at time of delivery and shall not be less than two (2) inches.
3. Pad size of individual pieces of sod shall be the supplier's standard width and length. Maximum allowable deviation from standard width and length shall be 5% or less. Broken pads or torn and uneven ends shall be rejected.
4. Moisture content of the sod shall not be harvested, transported, or installed if excessively dry or excessively wet.
5. Sod shall be no less than 10 months old nor more than 24 months old at the time of harvest.
6. Sod shall be harvested, transported, and installed within 36 hours of harvesting. Sod not installed within the 36 hours shall be inspected and approved by the Owner's Representative before proceeding.

2.3 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition:

B. 1 lb/1000 sq. Apply 3 oz. / 1000 sq. ft. in a minimum of 4.5 to 5 gal of water 30 days after planting Turfgrass Seed.

C. At each Fertilizer application apply 3 oz./1000 sq. ft. in a minimum of 4.5 to 5 gal of water.

D. Water in after each application.

E. Apex-10 can be mixed with insecticides, fungicides, and pre-emergent herbicides. DO NOT mix with or apply within 2 weeks of post-emergent herbicides.

F. Apex-10 can be applied through a hydroseeder.

G. Apex-10 is a unique product and as such NO SUBSTITUTIONS are available or will be permitted.

1. Newsom Seed Co, Fulton MD is the Mid-Atlantic Distributor of Apex-10 (800-553-2719) ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

H. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition:

a. 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
b. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

I. Apex-10 - Is Peat derived Humic Acid with naturally derived Polyhydroxy Carboxylic Acids.

1. Apply 3 oz. / 1000 sq. ft. in a minimum of 4.5 to 5 gal of water 30 days after planting Turfgrass Seed.
2. At each Fertilizer application apply 3 oz./1000 sq. ft. in a minimum of 4.5 to 5 gal of water
3. Water in after each application.
4. Apex-10 can be mixed with insecticides, fungicides, and pre-emergent herbicides. DO NOT mix with or apply within 2 weeks of post-emergent herbicides.

5. Apex-10 can be applied through a hydroseeder.
6. Apex-10 is a unique product and as such NO SUBSTITUTIONS are available or will be permitted.
7. Newsom Seed Co, Fulton MD is the Mid-Atlantic Distributor of Apex-10 (800-553-2719).

2.4 PESTICIDES

A. All pesticide applications must be coordinated with and approved by the CCPS Office of Environmental Issues Program.

1. IPM laws of CCPS and IPM laws for Maryland Schools must be followed.
2. Only chemicals from the approved CCPS list can be utilized.
3. No pesticide applications shall be permitted while students are on the premises.

2.5 MULCH FOR SEEDED AREAS - Turfgrass Seeding and Sodding

A. Mulch for seeding shall be weed free Barley or Wheat straw ONLY. Hay of any type or straw which is wet, moldy, or showing crop sprout shall not be permitted.

1. Straw mulch shall be applied at a rate of 3000-3500 lbs. per acre.
2. Straw shall only be applied by a straw blower / chopper.
3. Straw shall NOT be applied by hand.

B. STRAW ANCHORING - Turfgrass Seeding and Sodding

1. Straw shall be crimped into the soil with a straw crimper.
2. Straw shall have a tack coat of a non-dyed Hydro Mulch product applied by a Hydro Seeder.
3. Asphalt tack coats are STRICKLY FORBIDDEN to prevent exposure to students and tracking of asphalt into the school.

2.6 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

C. Erosion-Control Mats: Cellular, nonbiodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 3-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable, or which is dusty.

B. Planting Seasons - Turfgrass Seeding and Sodding

1. Seed: Planting Dates: Refer to 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, and as amended, "Table B.5: Recommended Planting Dates for Permanent Cover in Maryland".

a. Seed shall not be planted if soil temperatures are less than 55 degrees F.

2. Sod: Planting Dates: Refer to 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, and as amended, "Table B.5: Recommended Planting Dates for Permanent Cover in Maryland".

a. Sod should not be planted if daytime temperatures are more than 80 degrees F and shall not be planted if temperatures are 85 degrees F or higher.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation." Or Section 329115 "Soil Preparation (Performance Specification)."

B. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade and / or Place manufactured planting soil over exposed subgrade.

1. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.

3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Seeding Rate: Refer to 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, and as amended, "Table B.3: Selected List of Permanent Herbaccous Seeding Mixtures".

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 3:1 or as directed on construction plans with erosion-control blankets installed and stapled according to manufacturer's written instructions. Refer to 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, and as amended.

E. Protect seeded areas with slopes not exceeding 3:1 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

F. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.6 HYDROSEEDING

A. Hydroseeding: Mix specified seed, commercial fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
3. Spray-apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.7 SODDING

A. Lay sod within 24 hours of harvesting unless a suitable preservation method is accepted by Architect prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.

B. Moistening the Soil: During periods of high temperature and/or excessively dry periods, after all unevenness in the soil surface has been corrected, the soil shall be lightly irrigated immediately prior to laying the sod.

C. Starter Strip: The first row of sod shall be laid in a straight line usually along a building, sidewalk or curb.

D. Start the first row with a full sod pad. Start the second row with a ½ pad with subsequent rows alternating starting with full pads and half pads all placed parallel to and tightly against each other. Staggering lateral joints will promote more uniform growth and slow water running down slopes. Care shall be exercised to ensure that the sod is not stretched or overlapped and that all joints are butted tightly in order to prevent voids which would cause air drying of the roots and provide conditions for weeds to germinate.

E. Sloping Surfaces: On sloping areas where erosion may be a problem, sod shall be laid parallel to the contours of the slope (perpendicular to the flow of water), with staggered joints, and secured by non-treated pine wood stakes as required to secure sod. Stakes shall be driven flush with top of the sod. No metal staples or pegs may be used.

F. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 3:1.
2. Anchor sod on slopes exceeding 6:1 with wood pegs spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

G. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

H. Watering and Rolling: The landscape contractor shall lightly water sod during installation to prevent excessive drying. As sodding is completed in any one section, the entire area shall be rolled. It shall then have the first application of Apex-10 at 3oz. per 1000 sq. ft. in 4.5 to 5 gal of water. Follow the Apex-10 with sufficient water as to saturate the sod pad and the soil immediately below the sod to the point of being thoroughly wet (to a depth of 2-4 inches below the sod. Water as per section 2.3.C.

3.8 TURF RENOVATION

A. Renovate existing turf where indicated.

B. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.

J. Apply seed and protect with straw mulch as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.9 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Continue maintenance and establishment of all turfgrass areas by following a sound maintenance plan to include but not be limited to watering, fertilizing, weeding, mowing, trimming applying pesticides as necessary and other operations. Bare spots which exist after three (3) weeks of favorable growing weather shall be re-cultivated, reseeded, raked, and rolled as specified in Section 3.2. Soil Preparation" Mulching shall be with clean barley or wheat straw. Reseeding of bare spots shall be done as many times as necessary to establish a final acceptance of 95% coverage as determined by the Owner.

C. Contractor shall keep on site a diary of procedures applied to the turfgrass from the day installed until final acceptance by the Owner. This diary shall include dates, applications, rates, the weather on the day of application and who did the application.

1. Diary shall be on site anytime work is being accomplished.
2. Diary shall be made available to Owner's Representative upon verbal request.
3. Failure to provide or maintain diary will be cause to stop work and/or remove contractor from site.

D. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. NOTE - Watering Recommendations: An exact watering schedule is impossible due to the variability of the air temperature, wind speed, rains, and other uncontrollable factors. Therefore, utilize the following as guidelines. In the end YOU are responsible for over watering or under watering. Ultimately 1" of water is desired per week of "Maintenance" from either "Mother Nature" or applied by Contractor. However, OVER WATERING MAY BE AS DETRIMENTAL OR MORE DETRIMENTAL TO TURFGRASS THAN INSUFICIENT QUANTITIES. Both are detrimental to quality turf so extreme attention to watering is recommended.

    a. Install seed by dry-seeding or hydro-seeding as specs require.
    b. Roll all areas where it is practical to ensure good soil to seed contact.
    c. Lightly water the seed. Water as much as possible but not so much as the water "runs" or moves seed. Mist or light shower nozzles are a plus.
    d. Water lightly at least every day for two to three weeks. Multiple times a day may be required if temperatures dictate it. The idea is to keep the seed moist to encourage germination.
    e. Once seedlings appear (Usually 7-10 days you will begin to see green hairs) continue watering but increase the water amount slightly.
    f. Once grass plants begin producing a second leaf start monitoring watering by utilizing rain gauges or similar devices which can be visible or monitored outside the watering area in a method approved by Architect to indicate quantity of water applied, but only fill approximately ½ inch every day for a week.
    g. REMOVE methods of measurement AFTER EACH WATERING and PLACE AGAIN FOR NEXT WATERING or damage to the turf will result.
    h. The next week water every other day which should be approximately ¾ to 1 inch.
    i. The next week water every other day.
    j. The following week water every third day.
    k. Finally water once a week as weather permits.
    l. Anytime turf is too wet to walk on do not water.
    m. Anytime turf looks dry (blue/gray color) water.
    n. Anytime turf "crunches" under foot or leaves footprints as walking across, water.

E. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow perennial ryegrass to a height of 1 to 2 inches.
2. Mow Kentucky bluegrass to a height of 1-1/2 to 2 inches.
3. Mow turf-type tall fescue to a height of 2 to 3 inches.
4. Do not delay mowing until grass blades bend over and become matted.
5. If turf should exceed 4 inches due to weather conditions. Remove 1/3 of the plant blades, return to mow again in 2 days. Continue until mowing height returns to 2.5 inches. Excessive leaf clippings must be vacuumed or raked off of turf and properly disposed offsite.
6. Do not mow when grass is wet.
7. Do not mow if possible when temperature is above 850F and absolutely no mowing at 90 degrees F or above. If mowing occurs at temperatures above 85 degrees F, or above,
8. irrigate immediately after mowing.
9. Any "windrows" or clumps of cut grass must be removed and disposed of properly off site and at the Contractors expense.
10. Only well-maintained mowers with sharp blades with all safety equipment in place shall be used.
11. All line trimmers must have all standard safety equipment in place and used.
12. Any oil, gasoline, diesel or other petroleum products leaked or spilled on the turfgrass will result in an area being excavated twice as wide as the spill area in all directions and twice as deep as spill material can be found in the soil. Excavated soil shall be disposed of as hazardous material per the Laws and Regulations under the Maryland Department of the Environment. New fresh topsoil shall be added and the turfgrass re-established. All associated costs are the responsibility solely of the Contractor.

F. Turf Postfertilization: Apply commercial fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.10 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 95 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

3. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.
4. Satisfactory Sprigged Turf: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants, and areas between sprigs are free of weeds and other undesirable vegetation.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.11 SODDED TURFGRASS MAINTENANCE

A. General maintenance shall include but not limited to:

1. 10 days after initial sodding the Owner's Representative shall do a "work acceptance" inspection to verify that all work has initially been completed satisfactorily. This shall include:

   a. Verifying a uniform healthy stand of mature sodded turfgrass with:

      1) Good uniform color.
      2) Tightly butted joints with no gaps or open areas.
      3) Good healthy roots are extending into the topsoil.
      4) Soil under turfgrass sod to be smooth and safe to walk or play on.
      5) Proper drainage with no puddling 2-3 hours after irrigation or rain.

   b. Verifying a uniform and proper soils preparation under the turfgrass.

      1) Probed cores of soil shall be taken to verify that ALL soil preparation including but not limited to removing all debris, loosening subsoil, proper depth of screened topsoil, uniform blending of topsoil with sub soil to create a transition zone, the addition of organic matter as needed, and the incorporation of other needed amendments.
      2) The owner reserves the right to have these soil cores tested for organic matter, nutrients, and pH to verify all amendments have been added.
      3) If test indicate amendments were properly added the Owner shall bear the cost of testing.
      4) If test indicate that any of the amendments are not compliant with the specifications, then the Contractor shall bear the cost of the testing and will correct all issues even if it requires the entire area to be destroyed and started over again.

2. If work fails to be accepted, complete all necessary corrections and an additional "work acceptance inspection shall take place after an additional 10 days." This may be repeated twice if necessary.

3. If after three (3) inspections (30 days) the Contractor has not successfully corrected all deficiencies the Owner reserves the right to bring another Contractor in to make the necessary corrections and the cost shall be the responsibility of the initial Contractor who was awarded the contract.
4. Once the "work acceptance" inspection is complete, the Contractor shall maintain the sodded turfgrass for no less than six (6) months to no more than one (1) year. The final inspection must be requested in writing to the Owner provided the sod was installed prior to an entire growing cycle May 1 to Oct. 30 or a period of 1 year has passed since work acceptance. The inspection will look for:

    a. Verifying a uniform healthy stand of seeded turfgrass with:

        1) Good uniform color.
        2) Turfgrass is weed free.
        3) Turfgrass is free of any visible insect damage.
        4) Turfgrass is free of any visible disease damage.
        5) Soil under turf has remained safe to walk or play on.
        6) Soil has not settled improperly.
        7) Review diary to verify that all maintenance application has been applied at the correct rates and proper timing.

3.12 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established. Areas which have been damaged by construction operations shall be restored to original condition.

D. Remove nondegradable erosion-control measures after grass establishment period.

E. At NO time is debris or rubbish to be buried on site. Burying debris or rubbish on site is cause to remove Contractor from this project and owner will have debris and rubbish removed at the Contractors expense. Owner reserves the right to remove a Contractor, found to bury debris or rubbish on this project, from other Baltimore County projects for which this same Contractor has been awarded and further reserves the right to block this Contractor from future contracts at owners' sole discretion.

3.13 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 60 days from date of Substantial Completion.

    a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

2. Sodded Turf: 60 days from date of Substantial Completion.
3. END OF SECTION 32 9200

SECTION 33 4000 - STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Baltimore County Department of Public Works Design Manual dated January 2000 and as amended.

C. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition. Alternate methods and/or materials may be submitted to the Architect for consideration. Those judged to be equal to that specified will receive written approval.

D. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated July, 2021 and as amended.

1.2 SUMMARY

A. This Section includes drainage systems outside the building. Systems include the following:

1. Storm drainage
2. Stormwater Management Facility

B. Related Sections:

1. Section 01 7700: Closeout Procedures
2. Section 31 3000: Excavating, Filling and Grading
3. Refer to sections relating to plumbing piping, drainage and vent systems and laboratory systems in Division 22.

1.3 DEFINITIONS

A. Drainage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of storm drainage.

1.4 PERFORMANCE REQUIREMENTS:

A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

B. Stormwater Management Permit: Stormwater management facilities shall be constructed in accordance with the approved drawings and the provisions of the Stormwater Management Permit.

C. Certification of Completed Facilities: As-Built and Certifications are required for this stormwater management facility. In order to properly prepare these documents, this stormwater management facility must be inspected by a Registered Professional Engineer at specific stages of the construction. The Contractor shall notify the Certifying Engineer and Owner at least five (5) working days prior to starting work on this stormwater management facility. The Contractor shall also contact the Certifying engineer at least two (2) working days prior for each required inspection item shown on the contract documents. Preparation and processing of the As-Built Plans and Certification will be the responsibility of the Owner.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for the following:

1. Cleanouts.
2. Piping.
3. Fittings.

C. Shop drawings for precast concrete manholes and other structures. Include frames, covers and grates.

D. Shop drawings for cast-in-place concrete or field-erected masonry manholes and other structures. Include frames, covers and grates.

E. Reports and calculations for design mixes for each class of cast-in-place concrete.

F. Inspection and test reports specified in the "Field Quality Control" Article.

G. Record drawings at Project closeout of installed water system piping and products according to Division 1 Section "Closeout Procedures", and "Project Record Documents".

1.6 QUALITY ASSURANCE

A. Environmental Agency Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems.

B. Utility Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems. Include standards of water and other utilities where appropriate.

C. Product Options: Drawings indicate sizes, profiles, connections, and dimensional requirements of system components and are based on specific manufacturer types indicated. Other manufacturer's products with equal performance characteristics may be considered.

D. In the event of a discrepancy between the Project Specifications, Construction Documents, Baltimore County requirements, or other guidelines set forth by the authorities having jurisdiction the more stringent will apply.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic structures in direct sunlight.

B. Do not store plastic pipe or fittings in direct sunlight.

C. Protect pipe, pipe fittings, and seals from dirt and damage.

D. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.

1.8 PROJECT CONDITIONS

A. Site Information: Data in subsurface investigation reports was used for the basis of the design. The data in the subsurface investigation report is not a part of the Contract. Conditions are not intended as presentations or warranties of accuracy or continuity between soil borings. The Owner, Architect or Engineers will not be responsible for interpretations or conclusions drawn from this data by the Contractor.

1. Additional test borings and other exploratory operations may be performed by the Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify Architect not less than 48 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without receiving Architect's written permission.

D. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate with interior building drainage systems.

B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cleanouts

a. Ancon, Inc.
b. Jones Manufacturing Co., Inc.
c. Josam Co.
d. Rockford Sanitary Systems, Inc.
e. Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.
f. Wade Div., Tyler Corp.
g. Zurn Industries, Inc., Hydromechanics Div.

B. High Density Polyeyhylene (HDPE) pipe and fittings

Hancor
Advance Drainage Systems (ADS)
Lane Enterprises

2.2 PIPES AND FITTINGS

A. Polyvinyl Chloride Schedule 40 (P.V.C. SCH40)(watertight).

B. Polyvinyl Chloride SDR 26 (P.V.C. SDR26)(watertight)

C. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, Class IV, Wall B, for gasketed joints.

1. Gaskets: ASTM C 443, rubber.

D. High Density Polyethylene (HDPE) pipe and fittings. Watertight Joint

2.3 SPECIAL PIPE COUPLINGS AND FITTINGS

A. Sleeve-Type Pipe Couplings: Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined, for nonpressure joints.

1. Sleeves for Concrete Pipe: ASTM C 443, rubber.
2. Sleeves for Plastic Pipe: ASTM F 477, elastomeric seal.
3. Sleeves for Dissimilar Pipes: Compatible with pipe materials being joined.
4. Bands: Stainless steel, at least one at each pipe insert.

2.4 MANHOLES

A. Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasket joints, and frame and cover, all in accordance with Baltimore County Standard Details. Include indented top design with lettering, equivalent to the following, cast into cover:

1. Storm Drainage Piping Systems: STORM SEWER.

2.5 STORM DRAIN INLETS

A. General: Pre-cast reinforced concrete, or cast-in-place concrete complete with frames and grates, all in accordance with Baltimore County Standard Details or as otherwise noted on the plans.

2.6 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Structures: Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

C. Structure Channels and Benches: Factory or held formed from concrete. Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.

1. Include channels and benches in manholes.

a. Manholes Channels: Concrete invert, formed to same width as connected piping, with height of the vertical sides to 3/4 of the pipe diameter. Form curved channels with smooth, uniform radius and slope.

1) Invert Slope: 2.5 percent through manhole.
2) Manhole Benches: Concrete, sloped to drain into channel.

a) Slope: 1 inch per foot.

b. Include channels and benches in storm drain inlets.

D. Storm Drain Inlet Channels: Concrete invert, formed to same width as connected piping, with height of the vertical sides to 3/4 of the pipe diameter. Form curved channels with smooth, uniform radius and slope.

(a) Invert Slope: 2.5 percent (1:40) through inlet.

E. Storm Drain Inlet Benches: Concrete, sloped to drain into channel.

(b) Slope: 1 inch per foot (1:12).

1. Ballast and Pipe Supports: Portland-cement design mix, 3000 psi minimum, with 0.58 maximum water-cement ratio.

a. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
b. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

2.7 PROTECTIVE COATINGS

A. General: Include factory - or field-applied protective coatings to structures and appurtenances according to the following:

1. In accordance with the Baltimore County Department of Public Works Specifications for Storm Drain Manholes.
2. Coating: Apply 2-coats, coal-tar epoxy, 15-mil minimum thickness, except where otherwise indicated.

a. a. Manholes: On exterior surfaces.
b. b. Storm Drain Inlets: On exterior surfaces.

2.8 CLEANOUTS

A. Description: ASME A112.36.2M, round, cast-iron housing with clamping device and found, secured, scoriated, cast-iron cover. Include cast-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

1. Light Duty: In earth or grass, foot-traffic areas.
2. Medium Duty: In paved, foot-traffic areas.
3. Heavy Duty: In vehicle-traffic service areas.2.9 RIPRAP

B. Stone for riprap shall be uniformly graded from the smallest to the largest pieces as specified in the Contract Documents. The stone will be accepted upon visual inspection at the point of usage, and shall conform to the following:

CLASS OF RIPRAP	WEIGHT RANGES lb (kg)	APPROX. SIZE in. (mm)
0	1-33 (0.5 - 15)	2-7 (50-175)
I	2-150 (1-70)	3-12 (75-300)
II	20-700 (10-320)	6-20 (150-500)
III	40-2000 (20-910)	8-28 (200-700)

2.9 GEOTEXTILES

A. Geotextiles shall conform to the class specified in the Contract Documents. The geotextile shall be manufactured from fibers consisting of long chain synthetic polymers, composed of a minimum 85 percent by weight of polyolephins, polyesters or polyamides. The geotextile shall resist deterioration from ultraviolet exposure. Geotextiles used in the construction of silt fence shall contain sufficient amounts of ultraviolet ray inhibitors and stabilizers to provide a minimum of 12 months of expected usable construction life at a temperature range of 0 to 120F (-18 to 49 C).

B. All values specified are minimum or maximum roll values.

C. C. Classes A through E Geotextiles shall have a 0.010 cm/sec minimum permeability when tested in conformance with D4491, and an apparent minimum elongation of 20 percent when tested for conformance with the grab tensile strength requirements specified below. Classes A through E Geotextiles shall also conform to the following additional requirements:

GEOTEXTILE CLASS	MAXIMUM APPARENT OPENING SIZE mm	GRAB TENSILE STRENGTH lb (N) min	MINIMUM BURST STRENGTH psi (MPa)
A	0.30	250 (1110)	500 (3.4)
B	0.60	200 (890)	320 (2.2)
C	0.30	200 (890)	320 (2.2)
D	0.60	90 (400)	145 (1.0)
E	0.30	90 (400)	145 (1.0)

D. Class F Geotextiles (Silt Fence) shall have a 50 lb/in. minimum tensile strength and a 20 lb/in. minimum tensile modulus when tested in conformance with D4595. The material shall also have a 0.3 gal/ft² (12.21/m²) per minute minimum flow rate and a 75 percent minimum filtering efficiency when tested in conformance with D 5141.

E. The properties shall be determined as follows:

TEST	METHOD
Apparent Opening Size	D 4751
Grab Tensile Strength	D 4632, Grab Test - 4 x 8 in. (100 x 200 mm) specimen, 1 x 2 in. (25 x 50 mm) clamps; 12 in. (300 mm)/minute strain rate both principal directions of geotextile.
Burst Strength	D 3786

Sewing of the geotextile will be allowed provided it conforms to the following:

1. Seams shall be either "J" or "butterfly" type and shall utilize a lock stitch.
2. Seams shall conform to the tensile strength requirements for the geotextile when tested across the seam.
3. The thread for seaming shall be of equal or greater durability than the geotextile itself.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section 31 2300 "Excavating and Filling."

3.2 IDENTIFICATION

A. Materials and their installation are specified in Division 2 Section 31 2300. Arrange for installation of green detectable warning tapes directly over piping and at outside edges of underground structures.

3.3 PIPING APPLICATIONS

A. General: Include watertight, silttight, or soiltight joints, except where watertight or silttight joints are indicated.

B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to the following applications.

C. High Density Polyethelene Pipe (HDPE), Hancor Blue Seal corrugated polyethylene pipe installed per manufacturers' specifications.

D. Reinforced-concrete sewer pipe and fittings; rubber gaskets; and gasketed joints.

E. Polyvinyl Chloride (PVC) pipe: ASTM D 3034, PVC, solvent-cemented, sewer pipe fittings; and solvent-cemented joints.

3.4 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

A. Special Pipe Couplings: Use where indicated and where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

1. Use the following pipe couplings for nonpressure applications:

a. Strait-pattern, sleeve type to join piping, of same size, with small difference in outside diameters.
b. Increaser/reducer-pattern, sleeve type to join piping of different sizes.
c. Gasket type to join piping of different sizes where annular space between smaller piping's outside diameter and larger piping's inside diameter permits installation.
d. Internal-expansion type to join piping with same inside diameter.

B. Special Pipe Fittings: Use where indicated.

3.5 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of underground drainage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated, to extent practical and in accordance with the requirements of the Baltimore County Specifications and in accordance with the pipe manufacturer's written instructions. Where installation details are not shown on the Drawings, installation shall be in accordance with the Baltimore County Standard Details.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use manholes for changes in direction.

D. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited, except as indicated on the plans.

E. Install piping at constant slope between points and elevations indicated. Install straight piping runs at constant slope, not less than that specified, where slope is not indicated.

F. Extend piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

G. G. Install piping pitched down in direction of flow, at minimum slope of 1 percent and 36-inch minimum cover, except where otherwise indicated.

3.6 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to the following.

B. Polyvinyl Chloride Schedule 40 Pipe (P.V.C. SCH40) Pipe and Fittings: Join and install in accordance with manufacturer's instructions.

C. Concrete Pipe and Fittings: Install according to ACPA "Concrete Pipe Handbook." Use the following seals:

1. Round Pipe and Fittings: ASTM C 443, rubber gaskets.

D. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and fit both systems' materials and dimensions.

3.7 MANHOLE INSTALLATION

A. General: Install manholes, complete with accessories, as indicated.

B. Form continuous concrete channels and benches between inlets and outlet, where indicated.

C. Set tops of frames and covers flush with finished surface where manholes occur in pavements. Set tops 3 inches above finished surface elsewhere, except where otherwise indicated.

D. Place precast concrete manhole sections as indicated, and install according to ASTM C 891.

1. Provide rubber joint gasket complying with ASTM C 443, at joints of sections.
2. Apply bituminous mastic coating at joints of sections.

E. Construct cast-in-place manholes as indicated.

3.8 STORM DRAIN OUTFALL INSTALLATION

A. Install concrete end sections as indicated.

B. Construct riprap of broken stone, as indicated.

3.9 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318, ACI 350R, and as indicated.

3.10 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in pipe.

B. Set cleanout frames and covers in concrete paving with tops flush with surface of paving.

C. Cleanouts located in paving shall have countersunk lids.

3.11 CLOSING ABANDONED DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either of the following procedures:

1. Close open ends of piping with at least 8-inch-thick brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Structures: Excavate around structure as required and use either of the following procedures:

1. Remove structure and close open ends of remaining piping.
2. Remove top of structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
3. Backfill to grade according to Division 2 Section 31 2300 "Excavating and Filling."

3.12 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as the work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plug in end of incomplete piping at end of day and whenever work stops.
3. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of the Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visual between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedures until results are satisfactory.

C. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.

3. Schedule tests, and their inspections by authorities having jurisdiction, with at least 24 hours advance notice.
4. Submit separate reports for each test.
5. Where authorities having jurisdiction do not have published procedures, perform tests as follows:

    a. Storm Drainage: Perform hydrostatic test.

D. Allowable leakage is a maximum of 200 gallons per inch nominal pipe size, for every mile of pipe, during a 24-hour period.

E. Close openings in system and fill with water.

F. Purge air and refill with water.

G. Disconnect water supply.

H. Test and inspect joints for leaks.

I. Option: Test ductile-iron piping according to AWWA C600, Section 4 "Hydrostatic Testing." Use test pressure of at least 5 psig.

J. Option: Test concrete piping according to ASTM C 969.

K. Option: Test concrete arch piping and elliptical piping according to authorities having jurisdiction.

b. Storm Drainage: Perform hydrostatic test. Close openings in system and fill with water to not less than 10-foot head of water. Disconnect water supply. Water level must not drop for 15 minutes. Inspect joints for leaks.

L. Option: Test concrete arch piping and elliptical piping according to authorities having jurisdiction.

c. Storm Drainage: Perform air test according to UNI-B-6.

M. Option: Test round concrete piping, 24 inches and smaller, according to ASTM C 924.

N. Option: Test concrete arch piping and elliptical piping according to authorities having jurisdiction.

1. Manholes: Perform hydraulic test according to ASTM C 969.
2. Leaks and loss in test pressure constitute defects that must be repaired.
3. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

END OF SECTION

SECTION 33 4600 - SUBDRAINAGE

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 Department of Public Works Standard Details for Construction dated February 2000 and as amended.

C. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, dated July, 2021 and as amended.

D. Section 33 4000 - "Strom Drainage Utilities".

1.2 SUMMARY

A. Section Includes:

1. Perforated-wall pipe and fittings.
2. Drainage conduits.
3. Drainage panels.
4. Geotextile filter fabrics.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Drainage conduits, including rated capacities.
2. Drainage panels, including rated capacities.
3. Geotextile filter fabrics.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PVC Sewer Pipe and Fittings: ASTM D2729, bell-and-spigot ends, for loose joints.

2.2 DRAINAGE CONDUITS

A. Molded-Sheet Drainage Conduits: Prefabricated geocomposite with cuspated, molded-plastic drainage core wrapped in geotextile filter fabric.

1. Nominal Size: 12 inches high by approximately 1 inch thick.

a. Minimum In-Plane Flow: 30 gpm at hydraulic gradient of 1.0 when tested according to ASTM D4716.

2. Filter Fabric: PP geotextile.
3. Fittings: HDPE with combination NPS 4 and NPS 6 outlet connection.

B. Single-Pipe Drainage Conduits: Prefabricated geocomposite with perforated corrugated core molded from HDPE complying with ASTM D3350 and wrapped in geotextile filter fabric.

1. Nominal Size: 12 inches high by approximately 1 inch thick.

a. Minimum In-Plane Flow: [30 gpm] at hydraulic gradient of 1.0 when tested according to ASTM D4716.

2. Filter Fabric: PP geotextile.
3. Fittings: HDPE with combination NPS 4 and NPS 6 outlet connection.
4. Couplings: Corrugated HDPE band.

C. Mesh Fabric Drainage Conduits: Prefabricated geocomposite with plastic-filament drainage core wrapped in geotextile filter fabric. Include fittings for bends and connection to drainage piping.

1. Nominal Size: 6 inches high by approximately 0.9 inch thick.

a. Minimum In-Plane Flow: 2.4 gpm at hydraulic gradient of 1.0 when tested according to ASTM D4716.

2. Filter Fabric: Nonwoven geotextile made of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. when tested according to ASTM D4491.

2.3 DRAINAGE PANELS

A. Molded-Sheet Drainage Panels: Prefabricated geocomposite, 36 to 60 inches wide with drainage core faced with geotextile filter fabric.

1. Drainage Core: Three-dimensional, nonbiodegradable, molded PP.

a. Minimum Compressive Strength: 10,000 lbf/sq. ft. when tested according to ASTM D1621.

b. Minimum In-Plane Flow Rate: 2.8 gpm/ft. of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psig when tested according to ASTM D4716.

2. Filter Fabric: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M 288:

a. Survivability: Class 1.
b. Apparent Opening Size: No. 40 sieve, maximum.
c. Permittivity: 0.5 per second, minimum.

3. Film Backing: Polymeric film bonded to drainage core surface.

B. Mesh Fabric Drainage Panels: Prefabricated geocomposite with drainage core faced with geotextile filter fabric.

1. Drainage Core: Open-construction, resilient, plastic-filament mesh, approximately 0.4 inches thick.

a. Minimum In-Plane Flow Rate: 2.4 gpm/ft. of unit width at hydraulic gradient of 1.0 and normal pressure of 25 psig when tested according to ASTM D4716.

2. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from 120 to 200 gpm/sq. ft. when tested according to ASTM D4491.

2.4 SOIL MATERIALS

A. Soil materials are specified in Section 312300 "Excavating, Filling and Grading."

2.5 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.

1. Survivability: AASHTO M 288 Class 2.
2. Styles: Flat and sock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

C. Verify that drainage panels installed as part of foundation wall waterproofing is properly positioned to drain into subdrainage system.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312300 Excavating, Filling and Grading."

3.3 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.

F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

J. Install drainage panels on foundation walls as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at base of footing. Install as indicated in Part 3 "Piping Installation" Article.
3. Separate 4 inches of fabric at beginning of roll and cut away 4 inches of core. Wrap fabric around end of remaining core.
4. Attach panels to wall beginning at subdrainage pipe. Place and secure molded-sheet drainage panels, with geotextile facing away from wall.

K. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.4 UNDERSLAB DRAINAGE INSTALLATION

A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.

F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

H. Install horizontal drainage panels as follows:

1. Coordinate placement with other drainage materials.

2. Lay perforated drainage pipe at inside edge of footing.
3. Place drainage panel over drainage pipe with core side up. Peel back fabric and wrap fabric around pipe. Locate top of core at bottom elevation of floor slab.
4. Butt additional panels against other installed panels. If panels have plastic flanges, overlap installed panel with flange.

3.5 RETAINING-WALL DRAINAGE INSTALLATION

A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.

C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

D. Install drainage piping as indicated on drawings for retaining-wall subdrainage.

E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Install drainage panels on wall as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated drainage pipe at base of footing as described elsewhere in this Specification. Do not install aggregate.
3. If weep holes are used instead of drainage pipe, cut 1/2-inch- diameter holes on core side at weep-hole locations. Do not cut fabric.
4. Mark horizontal chalk line on wall at a point 6 inches less than panel width above footing bottom. Before marking wall, subtract footing width.
5. Separate 4 inches of fabric at beginning of roll and cut away 4 inches of core. Wrap fabric around end of remaining core.
6. Attach panel to wall at horizontal mark and at beginning of wall corner. Place core side of panel against wall. Use concrete nails with washers through product. Place nails from 2 to 6 inches below top of panel, approximately 48 inches apart. Construction adhesives, metal stick pins, or double-sided tape may be used instead of nails. Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.

7. If another panel is required on same row, cut away 4 inches of installed panel core and wrap fabric over new panel.
8. If additional rows of panel are required, overlap lower panel with 4 inches of fabric.
9. Cut panel as necessary to keep top 12 inches below finish grade.
10. For inside corners, bend panel. For outside corners, cut core to provide 3 inches for overlap.

J. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.6 LANDSCAPING DRAINAGE INSTALLATION

A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.

E. Add drainage course to top of drainage conduits.

F. After satisfactory testing, cover drainage conduit to within 12 inches of finish grade.

G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.7 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.

2. Underslab Subdrainage: Install piping level.
3. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 36 inches unless otherwise indicated.
4. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches unless otherwise indicated.
5. Lay perforated pipe with perforations down.
6. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install thermoplastic piping according to ASTM D2321.

3.8 PIPE JOINT CONSTRUCTION

A. Join perforated PE pipe and fittings with couplings according to ASTM D3212 with loose banded, coupled, or push-on joints.

B. Join perforated PVC sewer pipe and fittings according to ASTM D3212 with loose bell-and-spigot, push-on joints.

C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.9 BACKWATER VALVE INSTALLATION

A. Comply with requirements for backwater valves specified in Section 334100 "Storm Utility Drainage Piping."

B. Install horizontal backwater valves in header piping downstream from perforated subdrainage piping.

C. Install horizontal backwater valves in piping in manholes or pits where indicated.

3.10 CLEANOUT INSTALLATION

A. Comply with requirements for cleanouts specified in Section 334000 "Storm Utility Drainage Piping."

B. Cleanouts for Retaining-Wall and Landscaping Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches deep. Set top of cleanout flush with grade.
3. In nonvehicular-traffic areas, use NPS 4 PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 8 inches deep. Set top of cleanout 1 inch above grade.
4. Comply with requirements for concrete specified in Section 033000 "Cast-in-Place Concrete."

C. Cleanouts for Underslab Subdrainage:

1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.11 CONNECTIONS

A. Comply with requirements for piping specified in Section 334100 "Storm Utility Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to solid-wall-piping storm drainage system.

3.12 IDENTIFICATION

A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in Section 312300 "Excavation, Filling and Grading."

1. Install PE warning tape or detectable warning tape over ferrous piping.
2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.13 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

B. Drain piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.14 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 4600

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

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: CEN25-000001

Permit Type: Commercial Environmental

Sub Type: Grading

Date Issued: 03/14/2025

Expiration Date: 03/13/2027

Property Information

Property Address: 4401 FITCH AVE

City, State, Zip: NOTTINGHAM, MD, 21236

Tax ID: 1402000417

District: 14

Existing Use:

Proposed Use:

Is this property located in a Floodplain: NO

Sprinkler to be Installed?:

Plumbing Work?:

Electrical Work?:

Lot Size and Setbacks

Size:

Set Backs - Front Yard:

Set Backs - Rear Yard:

Set Backs - Right Side Yard:

Set Backs - Left Side Yard:

Owner Information

Owner: Baltimore County Property Management

Owner Address: 12200 Long Green Pike, Glen Arm, MD, 21057

Tenant:

Applicant: Seth Glasser

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: CEN25-000001

Permit Type: Commercial Environmental

Sub Type: Grading

Date Issued: 03/14/2025

Expiration Date: 03/13/2027

Building Permit Contractor

Name of Contractor: TBD

Phone Number:

Address:

City, State, Zip: , ,

Is Owner Contractor?:

Building Permit Information

Description of Work: Grade 4,975sf for replacement of retaining wall for fire station and associated hardscape areas. Permit expires two years from date of issue.
No construction to begin until pre-construction meeting. Failure to comply will result in penalties. Schedule your pre-construction meeting in your portal.

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: C22-03994

Permit Type: Commercial Alteration

Sub Type:

Date Issued: 12/02/2024

Expiration Date: 12/01/2025

Property Information

Property Address: 4401 FITCH AVE

City, State, Zip: NOTTINGHAM, MD, 21236

Tax ID: 1402000417

District: 14

Existing Use: Other

Proposed Use:

Is this property located in a Floodplain: NO

Sprinkler to be Installed?:

Plumbing Work?:

Electrical Work?:

Lot Size and Setbacks

Size: 2,857.00

Set Backs - Front Yard: 40.00

Set Backs - Rear Yard: 40.00

Set Backs - Right Side Yard: 30.00

Set Backs - Left Side Yard: 30.00

Owner Information

Owner: Baltimore County Office of Budget and Finance, Property Management

Owner Address: 20-G---130 COURT HOUSE, BALTIMORE, MD, 21204

Tenant:

Applicant: Zach Thomas

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

1256 A

12/02/2024

Baltimore County, Maryland
Department of Permits, Approvals, and Inspections
BUILDING PERMIT

Permit Number: C22-03994

Permit Type: Commercial Alteration

Sub Type:

Date Issued: 12/02/2024

Expiration Date: 12/01/2025

Building Permit Contractor

Name of Contractor: TBD

Phone Number:

Address:

City, State, Zip: , ,

Is Owner Contractor?:

Building Permit Information

Description of Work: INTERIOR ALTERATIONS TO INCLUDE: DEMO & CONSTRUCT DRYWALL PARTITIONS, MTL-STUD, CEILING TILE & GRID, ADA RESTROOMS, HVAC & DUCT WK, FIXTURES & FINISHES. SEPARATE PERMIT REQUIRED FOR ANY ADDITIONAL WORK. 2,857SF SEE C22-03968 ADDN

C. Pete Gutwald, AICP, Director

E. John Bryan, Building Engineer

***Please log into your account to get up-to-date information regarding the permit process and related inspections. Refer to the Permit Number when making inquires.**

1256 B

SECTION I V

Proposal

This Section to be Completed by Time of Bid

S E C T I O N – I V
P R O P O S A L

DESCRIPTION OF WORK

Bid Opening via Teleconference WebEx: Thursday, June 12, 2025 @ 10:30 a.m. EST.
WebEx Phone Number 1-415-655-0001, Access Code Number 2314 064 4223##.

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 "E" ($2,500,001 to $5,000,000) (Prequalified contractors with a Cost Group restriction must bid within the dollar amount stated on their Certificate of Prequalification)

Work Classification: I2 with a prequalified I8 & I9 subcontractors

TO BALTIMORE COUNTY, MARYLAND: The work consists of the expansion and renovation of the existing Baltimore County Fire Station #8. The project generally includes the renovation of approximately 2,660 square feet of bathroom, locker room, bunk room, support spaces and other work indicated in the contract documents. **Fullerton - District 14c5.**

The following listed Drawing Number(s) are collectively the "Drawings", and are hereby incorporated in the Contract.

Workday Number	Drawing Number(s)
200540012	2022-2320 thru 2374

A pre-bid meeting will be held on Wednesday, May 21, 2025 at 10:00 a.m. EST via WebEx. *Phone-In (Audio Only)* – 1-415-655-0001, Meeting Number 2306 251 0031##. *Video Conference* – Meeting Number 2306 251 0031 ,**Password**: **kJU6PjKpR26,** 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 Contraction", 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

Fullerton Fire Station #8 Ladies Renovation & Addition - 4401 Fitch Avenue, Nottingham, Maryland 21236
CONTRACT NUMBER: 25034 PF0 Re-Bid
WORKDAY NUMBER: 200540012
N/A
Manns Woodward Studios, 10839-D Philadelphia Road, Nottingham, MD. 21162

CONTRACTOR: _____
ADDRESS: _____
PHONE: _____

BID ITEM	COMM. CODE		DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	0	0000	FULLERTON FIRE STATION #8 LADIES RENOVATION & ADDITION	LS	1		$
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.

l0. 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: _____

Name: _____

Date: _____ 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.)]

Fullerton Fire Station #8 Ladies Renovation & Addition
Contract Name

25034 PF0 Re-Bid
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 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.

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 Obligee a formal contract and good and sufficient payment and performance bonds in the form provided by the Obligee, then, this obligation to be void; otherwise the Principal and Surety will, upon demand, pay unto the Obligee 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

Revised
February 4, 2015

BALTIMORE COUNTY
PREVAILING WAGE AND LOCAL HIRING

AFFIDAVIT

(Project Name) _____
Proposal No.: _____
Project No.: _____

On behalf of_____, I do solemnly declare and affirm,
(Contractor)
under penalty of perjury, that to the best of my knowledge, information, and belief:

1. I have submitted all documentation in accordance with Baltimore County Code § 10-2- 506 and § 10-2-507 regarding the prevailing wage and local hiring laws and requirements of the prevailing wage guidelines located at (Prevailing Wage and Local Hire Laws), and acknowledge that I have read and agree to all provisions of said law, as amended, and have a continuing obligation to be compliant with the law and any changes to the law.

2. I shall not knowingly provide any false information relating to payroll documentation and/or hiring of local employees for capital improvement contracts that are subject to the prevailing wage and/or local hiring laws of Baltimore County. I further attest and certify that all documentation relating to the same will be accurate and complete and will remain accurate and complete on an ongoing basis, and will reflect the payroll and/or local hiring status of contractors, subcontractors, apprentices, and independent contractors performing work for the Contract (contract number_____). I acknowledge that I have been informed and am aware of the foregoing requirements and that I am authorized to make this certification on behalf of myself and all subcontractors and parties performing work pursuant to this Contract.

3. I certify and attest that I am an officer or agent of the Contractor or subcontractor who supervises the payment of employees. I understand and agree that all documentation related to prevailing wages and/or local hiring required by law shall be submitted to Baltimore County's Prevailing Wage Administrator or designee before any surety is released or final payment due under the terms of the Contract is made.

4. I further certify and attest that I will have personal knowledge of the wages paid to all employees of_____for work performed on the Contract and of all of the hours worked, and that I am an authorized agent of the Contractor and assume responsibility for my actions.

5. I further certify and attest that_____will comply with prevailing wage rates set by the State of Maryland as the same apply to the Contract and are a part of the bid documents and Contract, and that_____will comply with applicable local hiring requirements.

6. I attest and certify that, if the Contract is subject to the local hiring requirement under §10-2-507 of the Baltimore County Code, _____ will make best efforts to ensure that residents of Baltimore County constitute at least 51% of the new hires made for the Contract, subject to all exceptions allowable by law.

7. I certify and attest that, if the Contract is subject to prevailing wage requirements, no rebates or deductions will be made, directly or indirectly, from any wages paid in connection with the Contract, other than those provided for by law.

8. I certify and attest that, if awarded the Contract and if the Contract is subject to prevailing wage law, I will submit certified payroll to the County through its electronic compliance system or as instructed by the Prevailing Wage and Local Hire Unit.

9. I certify that if awarded the Contract, I will provide a list of subcontractors who will participate as a beneficiary of this project to the agency and the Prevailing Wage and Local Hire Unit at PrevailingWage@baltimorecountymd.gov.

10. I understand that no funds will be dispersed by the County until an Employment Analysis has been issued to the Prevailing Wage and Local Hire Unit in compliance with the local hire law. The Employment Analysis will include how many jobs will be required to complete the project; how many current employees are available to complete the project, and how many of those jobs will require new hires.

_____
Contractor/Bidder/Offeror

_____
By

_____
Printed Name

_____
Printed Title

_____
Date

_____
Phone

_____
License Number

_____
Business Email

BALTIMORE COUNTY, MARYLAND

Prevailing Wage and Local Hiring Contract Requirements and Policies

The Contractor and all Subcontractors must comply with the Prevailing Wage and Local Hiring Laws, contained in Baltimore County Code § 10-2-506 and § 10-2-507, respectively, as amended. Prevailing wage means the wage rate paid by employers that is determined by a governmental authority, based upon a particular geographic area, for a given class of labor and type of project. The County will use the prevailing wage established by the State of Maryland (the "State") Department of Labor for state funded construction contracts in the County at the time of award. These rates include the basic hourly rate and fringe benefits. Apprentices must be paid at least the rate that the State's Apprenticeship and Training Council sets for an apprentice in the trade involved, based on a percentage of the prevailing wage rate in that trade. Any Contractor that is subject to the prevailing wage or local hiring law will be required to agree to the below provisions:

For the purposes of these requirements, an employee means an apprentice, laborer or mechanic employed by a contractor or subcontractor on a capital improvement project with a value of over $300,000 or a County-subsidized capital project with a value over $5,000,000.

Capital Improvement Project does not include blanket order or open-end agreements, capital improvement projects subject to a federal or state prevailing wage law, awarded without competition; with another governmental entity; to the extent the contractor is precluded from compliance by the terms of any federal or state law, contract or grant; entered into pursuant to Baltimore County Code § 10-2-310(e); entered into as a joint or cooperative purchase; or entered into as an emergency purchase.

The purpose of a prevailing wage is to ensure that contractors institute local hiring practices for Capital Improvement contracts and Capital Projects under certain circumstances as required by law, and that the Contractor's employees who work on capital improvement contracts are paid the going rate for their services. The prevailing wage rates are established by the State of Maryland Department of Labor and apply to all of the Contractor's employees and any and all Subcontractors. The Contractor and all Subcontractors must comply with all of the requirements of the Prevailing Wage Law including, but not limited to, the following:

1. Pay employees the prescribed rate as annually established by the State's Department of Labor; the prevailing wage rates in effect on the date a solicitation is issued and will apply throughout the term of a contract resulting from that solicitation. Contractor or subcontractors may NOT split or subdivide a capital improvement contract, pay an employee through a third party, treat an employee as a subcontractor or independent contractor to avoid any requirement of the County's prevailing wage law; or employ an individual classified as a helper or trainee to perform direct and measurable work on a capital improvement contract.

2. Pay employees at a rate equal to or more than the prevailing wage rate currently in effect for the type of work performed.

3. Pay employees overtime for work (I) more than eight hours in any single calendar day; (II) more than 40 hours in a work week; or (III) on a Sunday or a legal holiday.

4. Classify employees in their proper work classification in conformance with the schedule established by the State's Department of Labor.

5. May only make fair and reasonable deductions that are (a) required by law; (b) authorized in a written agreement between an employee and contractor or subcontractor signed at the beginning of employment (any deductions taken from employee paychecks including healthcare, pension, 401K, IRA, etc., child/spouse support, or tax levies); and submitted by the contractor or subcontractor to the Director of the County's Prevailing Wage Program; or required or allowed by a collective bargaining agreement between a bona fide labor organization and a contractor or subcontractor.

> Electronically submit a certified copy of payroll records through the County's designated certified payroll and compliance system within 14 days after the end of payroll week ending date, to verify that Prevailing Wage rates have been paid to employees.

6. Backup documentation may be required upon demand from the County to be submitted for all 3rd party benefits being claimed, to include, but not limited to: *one month's healthcare transmittal showing employee name and amount company pays on their behalf, company vacation/sick policy, etc. or if Union, a Union transmittal for one month in which work has been performed*.

7. Retain records for a period of five (5) years after the work is completed and permit the Director of the County Prevailing Wage Program, or his/her designee, to inspect the payroll records at a reasonable time and as often as necessary.

8. Payroll records shall contain a statement signed by the contractor or subcontractor (including tiered subcontractors) certifying that the payroll records are complete and correct; the wage rates are not less than required by the Prevailing Wage Law; and the rate of pay and classification for each employee accurately reflects the work the employee performed.

9. All payroll records shall include the name, address, telephone number and email address of the contractor or subcontractor; the name and location of the job; and each employee's name, current address, unless previously reported; specific work classification; daily basic time and overtime hours; total basic time and overtime hours for the payroll period; rate of pay; fringe benefits by type and amount; and gross wages, and any deductions taken from employees' paychecks including, but not limited to, healthcare, pension/401K/IRA. Late submission of copies of any payroll records may be deemed deficient by the County until the required records are provided, and the County may postpone processing payments due under the Contract or under an agreement to finance the Contract.

10. Submit to random or regular audits and investigation of any complaint of a violation of the County's Prevailing Wage and Local Hiring Laws and requirements.

11. Make best efforts to fill at least 51% of new jobs required to complete the capital improvement contract or capital project with Baltimore County residents.

12. Submit monthly reports to the Director of the County's Prevailing Wage Unit relating to local hiring with respect to capital improvement contracts over $300,00 or County-subsidized capital construction projects receiving assistance over $5,000,000, that includes (a) the number of new hires needed for the contract or project, (b) the number of County residents hired during the reporting period, (c) the total number of all employees hired during the contract period, (d) best efforts made to fill open positions with County residents, and(e) 5) for new hires: name, last four (4) digits of the social security number, job title, hire date, address and referral source.

13. Agree that any and all disputes will be handled as set forth in the County's Prevailing Wage and Local Hire as a condition of award.

14. In the event the County determines that a provision of the Prevailing Wage and/or Local Hire Law has been violated, the County shall issue a written decision, including appropriate sanctions, and may withhold payment due the Contractor in an amount sufficient to pay each employee of the Contractor or any subcontractors the full amount of wages due under the Prevailing Wage Law, and an amount sufficient to satisfy a liability of the Contractor for liquidated damages as provided under the Prevailing Wage Law, pending a final decision on the violation by the County. The Contractor may appeal a written decision of the Director of the County's Prevailing Wage Unit that the Contractor violated a provision of the Prevailing Wage and/or Local Hire Law, to the Office of Administrative Hearings ("OAH"), within ten (10) working days after receiving a copy of the decision. OAH will conduct a hearing upon the receipt of a timely appeal. If no appeal, the decision of the Director of the County's Prevailing Wage Unit or his/her designee becomes final. A Contractor who is found to have violated the provisions of the Prevailing Wage or Local Hiring Laws intentionally, may not be awarded a County contract or work on any County project for a period of one year from the date of the OAH determination.

15. May not discharge, or otherwise retaliate against, an employee for asserting any right under the Prevailing Wage Law or for filing a complaint of a violation;

16. An aggrieved employee is a third-party beneficiary of the Contract and may by civil action recover the difference between the prevailing wage for the type of work performed and the amount actually received, with interest and a reasonable attorney's fee.

17. Each Contract subject to the Prevailing Wage and Local Hire Laws may specify the payment of liquidated damages to the County by the Contractor for any noncompliance with the Prevailing Wage and Local Law. Liquidated damages are:

a. $10 for each calendar day that the payroll records are late (payrolls are to be submitted no later than 14 days after the week ending date shown on Certified Payroll Record CPR); $20 for each day that an employee is misclassified and/or paid less than the prevailing

wage rate; and a civil penalty of $50 per violation of the requirement to post the prevailing wage rates at the work site.

b. $50 per month for each month the Local Hire report is not submitted by the last day of the existing month due.

These liquidated damages are solely related to prevailing wage and local hiring compliance and do not negate any other remedies available or set forth in the Contract, including delay damages or actual damages. These remedies are separate from, in addition to, and not in lieu of, any remedies available and set forth in the Contract, or at law, for other breaches or defaults under the Contract.

18. Where the initial Contract Sum is $300,000 or below, but it is subsequently increased and exceeds $300,000 due to an approved Contract Modification, the amount of any such Contract Modification that causes the Contract Sum to exceed $300,000 is subject to the Prevailing Wage and Local Hiring Laws.

19. The Contractor and all subcontractors must post a clearly legible statement of each prevailing wage rate in a prominent and easily accessible place at the Work Site during the entire time Work is being performed, in English and any other language that is primarily spoken by the employees, at the Work Site.

20. A contract may include the actual cost of health and dental insurance, pension or retirement plan, paid time off such as vacation or sick daysand life insurance. In calculating the cost per hour, divide the annual cost of benefits by 2,080 hours for each employee. Other benefits such as the use of a company vehicle, cell phones, lodging reimbursement, company owned tools **may not be credited towards the fringe benefit amount**.

21. All apprentices must be registered with the Maryland Apprenticeship and Training Council, V.A., or US DOL as well as be currently enrolled in, and attending appropriate classes, to which is considered “actively enrolled”. Only actively enrolled apprentices may be employed on the project at the apprentice prevailing wage rate.

CONTRACT NUMBER:
25034 PF0 Re-Bid

BALTIMORE COUNTY PREVAILING WAGE RATES
BUILDING CONSTRUCTION

Print Date 4/30/2025

Classification	Modification Reason	Basic Hourly Rate	Borrowed From	Fringe Benefit Payment
BALANCING TECHNICIAN	AD	$47.92		$24.44
BRICKLAYER	AD	$37.50		$14.78
CARPENTER	AD	$34.41		$14.49
CARPENTER - SHORING SCAFFOLD BUILDER	AD	$34.41		$14.49
CARPET LAYER	AD	$34.12		$14.86
CEMENT MASON	AD	$25.00	510	$1.94
COMMUNICATION INSTALLER TECHNICIAN	AD	$36.37		$12.89
DRYWALL - SPACKLING, TAPING, & FINISHING	AD	$34.41		$14.49
ELECTRICIAN	AD	$47.13		$21.94
ELEVATOR MECHANIC	AD	$56.36		$45.50
FIRESTOPPER	AD	$29.81		$10.08
GLAZIER	AD	$35.60		$14.41
INSULATION WORKER	AD	$40.02		$19.92
IRONWORKER - FENCE ERECTOR	AD	$40.02		$19.92
IRONWORKER - ORNAMENTAL	AD	$31.17	510	$24.38
IRONWORKER - REINFORCING	AD	$29.20	510	$23.57
IRONWORKER - STRUCTURAL	AD	$33.12		$25.63
LABORER - AIR TOOL OPERATOR	AD	$24.46		$9.69
LABORER - ASPHALT PAVER	AD	$24.46		$9.69
LABORER - ASPHALT RAKER	AD	$22.63		$4.88
LABORER - BLASTER - DYNAMITE	AD	$24.46		$9.69
LABORER - BURNER	AD	$24.46		$9.69
LABORER - COMMON	AD	$22.63		$4.88
LABORER - CONCRETE PUDDLER	AD	$22.63		$4.88
LABORER - CONCRETE SURFACER	AD	$24.46		$9.69
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 - HAZARDOUS MATERIAL HANDLER	AD	$24.46		$9.69
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 - MASON TENDER	AD	$24.46		$9.69
LABORER - MORTAR MIXER	AD	$22.63		$4.88
LABORER - PIPELAYER	AD	$24.46		$9.69
LABORER - PLASTERER - HANDLER	AD	$22.63		$4.88
LABORER - SCAFFOLD BUILDER	AD	$24.46		$9.69
LABORER - TAMPER	AD	$22.63		$4.88
MECHANICAL SYSTEMS SERVICE TECH - ELECTRICAL SYSTEMS	AD	$46.21	510	$24.90

MECHANICAL SYSTEMS SERVICE TECH-HVAC SYSTEMS	AD	$46.21		$24.90
MECHANICAL SYSTEMS SERVICE TECH-PLUMBING SYSTEMS	AD	$46.21		$24.90
MECHANICAL SYSTEMS SERVICE TECH - REFRIGERATION SYSTEMS	AD	$52.27	003	$24.58
MILLWRIGHT	AD	$38.61		$17.21
PAINTER	AD	$28.55		$11.87
PAINTER-INDUSTRIAL	AD	$35.55		$15.28
PILEDRIVER	AD	$36.60		$16.78
PLUMBER	AD	$46.21		$24.90
POWER EQUIPMENT OPERATOR - BACKHOE	AD	$33.00	510	$13.55
POWER EQUIPMENT OPERATOR - BROOM / SWEEPER	AD	$32.23	510	$14.62
POWER EQUIPMENT OPERATOR - BULLDOZER	AD	$34.18		$14.62
POWER EQUIPMENT OPERATOR - CONCRETE PUMP	AD	$44.35		$0.00
POWER EQUIPMENT OPERATOR - CRANE	AD	$41.00		$18.10
POWER EQUIPMENT OPERATOR - CRANE - TOWER	AD	$41.00		$18.10
POWER EQUIPMENT OPERATOR - DRILL - RIG	AD	$33.16		$14.15
POWER EQUIPMENT OPERATOR - EXCAVATOR	AD	$34.18		$14.62
POWER EQUIPMENT OPERATOR - FORKLIFT	AD	$34.18		$14.62
POWER EQUIPMENT OPERATOR - GRADALL	AD	$34.00	510	$13.55
POWER EQUIPMENT OPERATOR - GRADER	AD	$34.18		$14.62
POWER EQUIPMENT OPERATOR - GUARD RAIL POST DRIVER	AD	$23.50		$5.07
POWER EQUIPMENT OPERATOR - LOADER	AD	$34.18		$14.62
POWER EQUIPMENT OPERATOR - MECHANIC	AD	$36.24		$14.62
POWER EQUIPMENT OPERATOR - MILLING MACHINE	AD	$30.58	510	$13.55
POWER EQUIPMENT OPERATOR - PAVER	AD	$32.10	510	$13.55
POWER EQUIPMENT OPERATOR - ROLLER - ASPHALT	AD	$32.10	510	$13.55
POWER EQUIPMENT OPERATOR - ROLLER - EARTH	AD	$28.60		$14.62
POWER EQUIPMENT OPERATOR - SCREED	AD	$30.00	510	$11.80
POWER EQUIPMENT OPERATOR - SKID STEER (BOBCAT)	AD	$32.23		$14.62
POWER EQUIPMENT OPERATOR-VACUUM TRUCK	AD	$37.50		$14.85
RESILIENT FLOOR	AD	$34.12		$14.86
SHEETMETAL WORKER (INCLUDING METAL ROOFING)	AD	$47.92		$24.44
SPRINKLERFITTER	AD	$42.32	510	$26.05
SPRINKLERFITTER/PIPEFITTER	AD	$46.21		$24.90
STONE MASON	AD	$44.30	510	$21.22
TILE & TERRAZZO FINISHER	AD	$28.09		$12.59
TILE & TERRAZZO MECHANIC	AD	$33.41		$14.24
TRUCK DRIVER - DUMP	AD	$17.64	510	$1.92
TRUCK DRIVER - FLATBED	AD	$20.94		$7.63
TRUCK DRIVER - LOWBOY	AD	$29.68	510	$10.51
TRUCK DRIVER - TACK/TAR TRUCK	AD	$27.35	510	$8.97

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)(l) 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)(l) 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/Offeror Responsibility: The bidder/offeror shall ensure that MWBE participation occurs in accordance with the contract requirements and the County Executive's Executive Order. All bidder/offerors shall ensure that MWBE have the maximum opportunity to compete for and perform County contracts, as applicable. Baltimore County, Maryland, and/or its bidder/offerors 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/offeror 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/offeror 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/offerors shall submit the following information to the County at the time of bid submission:

1. The name of an employee designated as the bidder/offeror'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/Offeror. The prime shall submit a list of all subcontractors.

4. For DPW contracts, if the bidder/offeror 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/offeror intends to use a MWBE joint venture as a subcontractor to meet its MWBE requirements, the affidavit must be submitted through the bidder/offeror by the proposed subcontractors and signed by all parties.

5. If the bidder/offeror's proposed MWBE participation does not meet the MWBE contract requirements, information sufficient to demonstrate that the bidder/offeror has made every effort to meet the requirements must be submitted. (See DETERMINATION OF BID RESPONSIVENESS hereafter)

RECORDS AND REPORTS

Returning Records: The bidder/offeror 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/offeror, 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/offeror, 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 # 25034 PF0 Re-bid is a minimum of 25%. 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.

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	**Prime Address, Telephone Number and Email**
Bid/Proposal Name and Number	**Project Location**
	Base Bid $_____
1. Subcontractor Name and Tax ID	**Subcontractor Address**
Telephone Number _____ **Email Address** _____ **Select One:** ☐ **MBE** ☐ **WBE** ☐ **SBE** ☐ **N/A** **Provide if Applicable:** ☐ **MDOT** ☐ **Baltimore City** **#**_____	**Minority Status (If applicable):** ☐ **African American** ☐ **Female** ☐ **Asian American Pacific** ☐ **Native American** ☐ **Asian American Sub-continent** ☐ **Hispanic American** ☐ **Supplier, Wholesaler and/or Regular Dealer - 60% Rule**
NAICS Code(s), Work to be Performed and Subcontract Dollar Amount	**Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule)** _____%
2. Subcontractor Name and Tax ID	**Subcontractor Address**
Telephone Number _____ **Email Address** _____ **Select One:** **MBE** ☐ **WBE** ☐ **SBE** ☐ **N/A** ☐ **Provide if Applicable:** ☐ **MDOT** ☐ **Baltimore City** **#**_____	**Minority Status (If applicable):** ☐ **African American** ☐ **Female** ☐ **Asian American Pacific** ☐ **Native American** ☐ **Asian American Sub-continent** ☐ **Hispanic American** ☐ **Supplier, Wholesaler and/or Regular Dealer - 60% Rule**
NAICS Code(s), Work to be Performed and Subcontract Dollar Amount	**Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule)** _____%
3. Subcontractor Name and Tax ID	**Subcontractor Address**
Telephone Number _____ **Email Address** _____ **Select One:** **MBE** ☐ **WBE** ☐ **SBE** ☐ **N/A** ☐ **Provide if Applicable:** ☐ **MDOT** ☐ **Baltimore City** **#**_____	**Minority Status (If applicable):** ☐ **African American** ☐ **Female** ☐ **Asian American Pacific** ☐ **Native American** ☐ **Asian American Sub-continent** ☐ **Hispanic American** ☐ **Supplier, Wholesaler and/or Regular Dealer - 60% Rule**
NAICS Code(s), Work to be Performed and Subcontract Dollar Amount	**Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule)** _____%
Subcontractor Total Dollar Amount $_____	**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 _____

Rev 12/2024

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

CONTRACT AGREEMENT

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 **25034 PF0 Re-Bid** "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

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

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)

_____
Type (Print) Name

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:

_____ Date: _____
Kevin D. Reed, Director
Office of Budget and Finance

_____
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

P E R F O R M A N C E B O N D 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) DOLLARS	$_____
Fullerton Fire Station #8 Ladies Renovation & Addition **Contract Name**	_____ **20** _____ **Date of Contract**
25034 PF0 Re-Bid **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, 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

Revised
February 4, 2015

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**

Penal Sum of Bond (express in words and figures) _____ DOLLARS $_____

Contract Name Fullerton Fire Station #8 Ladies Renovation & Addition **Date of Contract** _____ **20** _____

Contract Number 25034 PF0 Re-Bid **Date Bond Executed** _____ **20** _____

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

Revised
February 4, 2015

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 Asbestos/Lead Removal/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.
(d) Removal of asbestos/lead or debris and building products containing asbestos/lead, transportation and disposal of asbestos/lead and contaminated materials.

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 1253 and General Conditions pages 34 & 35, Article 33.