# TAS/ADA FIRE MARSHALL
# DEFERRED MAINTENANCE PROJECTS

# MIDWESTERN STATE UNIVERSITY

WICHITA FALLS, TEXAS

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DATE: 7-10-17

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# Notice to Sub-Contractors and Material Suppliers
# Request for Competitive Sealed Proposals

Proposals will be received by Sealed Proposal or Email until 2:00 p.m., August 17th, 2017, at the office of the Director of Purchasing and Contract Management, 3410 Taft Blvd, Daniel Building Room 202, Wichita Falls, Texas 76308.

This is a "Public Works" Project and it is subject to Labor Standards and Practices set forth in various Statutes of the State of Texas.

Drawings and Specifications may be examined without charge at the offices of Harper Perkins Architects Inc. located at: 4724 Old Jacksboro Highway, Wichita Falls, Texas 76302-3599; and on line at MSU Purchasing website or M&F Littenken (CMaR) website.

Complete sets of Drawings, Specifications, and other Contract Documents may be obtained by qualified Contractors from the office of Harper Perkins Architects Inc., 4724 Old Jacksboro Highway, Wichita Falls, Texas 76302-3599, upon payment of a refundable deposit of Two Hundred Dollars ($200.00) as a guaranty of the safe return of the Drawings, Specifications and other Contract Documents.

A Bid Bond is required. No Proposal may be withdrawn for a period of sixty (60) days after the deadline without the consent of the Owner.

THE OWNER RESERVES THE RIGHT TO REJECT ANY/OR ALL PROPOSALS AND TO WAIVE ANY/OR ALL INFORMALITIES.

WAIVER OF CLAIMS: BY TENDERING A RESPONSE TO THE DISTRICT'S RFP, THE CONTRACTOR ACKNOWLEDGES THAT IT HAS READ AND FULLY UNDERSTANDS THE REQUIREMENTS FOR SUBMITTING A PROPOSAL, AND THE PROCESS USED BY THE DISTRICT FOR SELECTING A CONTRACTOR. FURTHER, BY SUBMITTING A PROPOSAL, THE CONTRACTOR FULLY, VOLUNTARILY AND UNDERSTANDINGLY WAIVES AND RELEASES ANY AND ALL CLAIMS AGAINST DISTRICT AND ITS TRUSTEES, OFFICERS, AGENTS AND/OR EMPLOYEES THAT COULD ARISE OUT OF THE ADMINISTRATION, EVALUATION, OR RECOMMENDATION OF ANY PROPOSAL SUBMITTED IN RESPONSE TO THIS RFP.

INSTRUCTIONS FOR SUBMITTING BIDS: Review ALL documents in their entirety. Be sure your bid is complete, and double check your bid for accuracy.

Questions requiring only clarification of instructions or specifications will be handled through the email process. If any questions results in a change or addition to this Bid, the change(s) and Additions(s) will be addressed to all vendors involved as quickly as possible in the form of an addendum. It is the responsibility of the bidder to view the posting on the MSU purchasing web page located at **http://mwsu.edu/purchasing/**.

Sign the Vendor's Affidavit Notice and return with your bid.

BIDDER SHALL SUBMIT BID ON THE FORM PROVIDED, SIGN THE VENDOR AFFIDAVIT AND RETURN ENTIRE BID PACKET. In the event of inclement weather and the University Offices are officially closed on a bid opening day, bids will be received until 2:00 p.m. of the next business day, at which time said bids will be privately opened.

BIDS SUBMITTED AFTER THE SUBMISSION OF DEADLINE SHALL BE RETURNED UNOPENED AND WILL BE CONSIDERED VOID AND UNACCEPTABLE.

1. Each bid shall be emailed or placed in a separate envelope completely and properly identified with the name and number of bid. Bids must be in the Purchasing Office BEFORE the hour and date specified.
2. Bids MUST give full firm name and address of the bidder. Person signing bid should show TITLE or AUTHORITY TO BIND HIS FIRM IN A CONTRACT.

3. Bids CANNOT be altered or amended after opening time. Any alterations made before opening time must be initialed by bidder or his authorized agent. No bid can be withdrawn after opening without the approval by the Vice-President of Administration and Finance based on a written acceptable reason.
4. The University is exempt from State Sales Tax and Federal Excise Tax. DO NOT INCLUDE TAX IN BID.

Any questions regarding this project and the proposal process should be directed to: Harper Perkins Architects Inc.; Phone: (940) 767-1421; Fax: (940) 397-0273; contact Glenda Ramsey, Project Architect; at **gramsey6@harperperkins.com** or Sam Kenshalo, Project Manager; at **skenshalo@harperperkins.com**; or Kevin Darnell, M & F Litteken (CMaR) at **kevindarnell@mflitteken.com**.

END OF NOTICE TO CONTRACTORS AND MATERILA SUPPLIERS

# INSTRUCTIONS TO PROPOSERS
## For Sealed Proposals
## For Subcontractors and Material Suppliers

Proposals, will be received from subcontractors and material supplies for the TAS/ADA Fire Marshall Deferred Maintenance Projects on the Campus of Midwestern State University, 3410 Taft, Wichita Falls, Texas, in accordance with the Contract Documents prepared by the Architect, HARPER PERKINS ARCHITECTS. Proposals will be received at the office of the Steve Shelley, Director of Purchasing & Contract Management, Daniel Building, at a time and date as designated by MSU. A pre-bid conference will be held July 27, from 10:00 to 12:00 and August 7, 2017 from 10:00 to 12:00, at the time and location as designated by MSU.
Please see specifications at the below Link under current bid opportunities listed under the RFP number: http://mwsu.edu/purchasing/ or complete sets of Drawings, Specifications and other documents may be obtained by qualified sub-contractors and Material Suppliers from the office of Harper Perkins Architects, Inc., 4724 Old Jacksboro Highway, Wichita Falls, Texas, upon payment of a refundable deposit of Two Hundred Dollars ($200.00).

Please supply a HUB Subcontracting Plan with your bid, which can be found at the below listed link: http:/www.window.state.tx.us/procurement/prog/hub/hub-subcontracting-plan/.

Supply an insurance certificate with your Bid.

Supply a W-9 with your Bid if new to Midwestern State University.

2010 Uniform General Conditions apply to this Bid and can be found at the below listed link: http://mwsu.edu/purchasing/contract -management.

A Bid Bond will be required to accompany your Bid. If awarded the Bid, a Payment Bond will be required if your Bid is over $25,000.00. If awarded the Bid, a Performance Bond will be required if your Bid is over $100,000.00.

PUBLIC WORKS PROJECT: This project is a "Public Works" project and the Contractor shall comply with the labor standards and practices as set forth in various annotated Civil Statutes of the State of Texas, and the Uniform General Conditions.

DRAWINGS AND SPECIFICATIONS: Drawings and Specifications may be examined without charge at the offices of Harper Perkins Architects, Inc., located at 4724 Old Jacksboro Highway, Wichita Falls, Texas. All Drawings and Specifications will be issued by MSU.

QUALIFICATION OF BUILDING CONTRACTORS: Proposals will be received only from qualified Building Sub-Contractors and material suppliers. The Owner reserves the right to reject any Proposal if the evidence submitted by, or investigation of such Contractor fails to satisfy the Owner that such Contractor is properly qualified to carry out the obligations of the contract and to complete the Work contemplated herein.

EXAMINATION OF SITE: Prior to the submittal of Proposals, each Sub-Contractor and material supplier shall make and will be deemed to have made a thorough examination of the various sites of the Work and all conditions existing thereon.

EXAMINATION OF CONTRACT DOCUMENTS: Before submitting Proposals, Building Contractors shall carefully examine the complete contract documents including the Drawings and Specifications and shall bring any discrepancies to the attention of the Architect.

CONDITIONS OF THE WORK: Each Contractor shall inform himself fully of the conditions relating to construction of the project and the employment of labor thereon. Failure to do so will not relieve a

successful Contractor of his obligation to furnish all material and labor necessary to carry out the provisions of the contract.

LAWS AND REGULATIONS: The Contractors attention is directed to the fact that all applicable State laws, and the rules and regulations of all authorities having jurisdiction over the construction of the project shall apply to the contract throughout and they are deemed to be included in the contract the same as though written therein in full.

INTERPRETATION OF CONTRACT DOCUMENTS: Prospective Building Contractors desiring further information or interpretation of the contract documents (Drawings and Specifications) shall request such data in writing from the Architect/Owner.

ADDENDA: Answers to all questions, inquiries, and requests for additional information will be issued in the form of addenda and copies of each addendum will be issued to all prospective Sub-Contractors and material suppliers. Also, prospective Sub-Contractors and material suppliers may, during the proposal period, be advised by addenda of additions to, deletions from, or changes in the requirements of the contract documents. The Owner will not be responsible for the authenticity or correctness of oral interpretations or for information obtained in any other manner than through the media of addenda. Receipt of each addendum shall be acknowledged by Sub-Contractors and material suppliers in their Proposals, and each addendum shall be considered a part of the contract documents. Failure to acknowledge receipt of addenda issued may invalidate a Proposal as incomplete.

IDENTIFICATION OF PROPOSALS: Proposals shall be submitted in sealed envelopes clearly marked with the name and number of the project as it appears on the cover page of the Specification and with the name and address of the Contractors.

QUALIFICATION OF BUILDING CONTRACTORS: A Building Contractor, in submitting a Proposal, thereby represents that he is fully qualified, properly licensed, staffed, and equipped to properly perform the work in accordance with applicable laws and local ordinances having jurisdiction.

WITHDRAWAL OF PROPOSAL: A Contractor may withdraw his Proposal, either personally or by telegraphic or written requests at any time prior to the scheduled closing time for the receipt of Proposals. After the opening of Proposals, they may not be withdrawn for a period of sixty (60) days after the date scheduled for the opening of Proposals.

PROPOSAL MODIFICATION: Any Contractor may modify his Proposal by changing the amount of the Proposal, either a deductive or additive amount on the exterior of the envelope prior to the opening and prior to the published Proposal time. The modification shall be signed and dated by an authorized representative of the Contractor. The modification shall not reveal the Proposal price but shall provide the addition or subtraction or other modification so that the final price or terms will not be known by the Owner until the sealed proposal is opened. If written confirmation is not received within two days from closing time, no consideration will be given to the modification. No telegraphic, telephone or facsimile modifications of the Proposal will be accepted.

LIQUIDATION OF DAMAGES: If the Contractor shall fail to fully complete the work within the time specified (subject however to an extension of time duly granted in a manner and for the cause specified in the GENERAL CONDITIONS), the Contractor shall be charged by the Owner as liquidated and ascertained damages the sum of Two Hundred Fifty Dollars ($250) for each calendar day that the work remains incomplete beyond the time fixed for the completion, it being hereby expressly and mutually agreed that from the nature of the case it would be impracticable and extremely difficult to fix the actual damage which would or will be suffered in the event that the Contractor should fail to fully complete the Work within the time specified, and it being further agreed that said charge herein provided for is reasonable and proper in the premises. The amount so charged may be deducted by the Owner from any money which might otherwise be or become payable to the Contractor.

END OF INSTRUCTIONS TO BUILDING CONTRACTORS

# AIA® Document A310™ – 2010

## *Bid Bond*

**CONTRACTOR:**
*(Name, legal status and address)*

**SURETY:**
*(Name, legal status and principal place of business)*

**OWNER:**
*(Name, legal status and address)*

**BOND AMOUNT:** $

**PROJECT:**
*(Name, location or address, and Project number, if any)*

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

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

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

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

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

Signed and sealed this day of ,

| | |
|---|---|
| | *(Contractor as Principal)* *(Seal)* |
| *(Witness)* | *(Title)* |
| | *(Surety)* *(Seal)* |
| *(Witness)* | *(Title)* |

# PROPOSAL FORM

**PROPOSAL OF:** _____
(Proposers Name)

REQUEST FOR PROPOSAL
FOR
MIDWESTERN STATE UNIVERSITY
TAS/ADA – FIRE MARSHAL DEFERRED MAINTENANCE PROJECTS
PURCHASING & CONTRACT MANAGEMENT DEPARTMENT
3410 TAFT BLVD, DANIEL BUILDNG, ROOM 202
WICHITA FALLS, TX 76308

Proposals are to be sent via email or hand delivered to:
Stephen Shelley, Director of Purchasing & Contract Management
3410 Taft Blvd, Daniel Building, Room 202
Wichita Falls, TX 76308
Stephen.shelley@mwsu.edu
940-397-4110

The undersigned, having examined the Drawings, Specifications and related Documents, the site of the proposed Work, being familiar with all of the conditions relating to the construction of the proposed project, including the availability of materials and labor, hereby proposes to furnish all labor, materials, services, equipment and appliances required in connection with or incidental to the construction of each item listed below in strict accordance with the following Specifications and Drawings:

SPECIFICATION SECTIONS: Instructions to Proposer, AIA General Conditions of the Contract for Construction AIA Document A201-2007, Sections Div. 1, Div. 2, Div. 3, Div. 4, Div. 5, Div. 6, Div. 7, Div. 8, Div. 9, Div. 10, Div.12, Div. 14, Div. 21, Div. 22, Div. 23, Div. 26 and Div. 31

| | | |
|---|---|---|
| COVER SHEET | | Dated June 16, 2017 |
| STRUCTURAL | S101, S102, S101, B-S201, B-S202, B-S203, B-S204, F-S201, FF-S201, FF-S202, FF-S203, H-S201, S301, S302, S401, S402, S403 | Dated June 16, 2017 |
| ARCHITECTURAL DEMOLITION | B-AD101, B-AD102, B-AD103, B-AD104, B-AD105, B-AD106, B-A101, B-A102, B-A103, B-A104, B-A105, B-A106, B-A107, F-AD101, F-A101, FF-AD101, FF-AD102, FF-AD103, FF-AD104, FF-AD105, FF-AD106, FF-AD107, FF-AD108, FF-AD109, FF-A101, FF-A102 ,FF-A103, FF-A104, FF-A105, FF-A106, FF-A107, FF-A108, FF-A109, FF-A110, FF-A111, H-AD101, H-AD102, H-AD103, H-AD104, H-AD105, H-A101, H-A102, H-A103, H-A104, H-A105, H-A105, H-A106, H-A107, H-A108, H-A109, B-A201, FF-A201, FF-A202, B-A301, B-A302, B-A303, FF-A301, FF-A302, FF-A303, FF-A304, A401, A402, A501, A502, B-A701, B-A702, FF-A701, FF-A702, FF-A703, H-A701, H-A702 | Dated June 16, 2017 |
| MECHANICAL | FP001, B-FP01, FF-FP01, H-FP01, P001, P002, B-PD101, B-PD102, B-P101. B-P102, F-PG01, FF-PD101, FF-P101, FF-P102, H-PD101, H-P101, P003, M001, M002, B-MD101, B-MG101, B-MG102, B-MG103, B-M101, B-M102, FF-MD101, FF-M101, M003 | Dated June 16, 2017 |
| ELECTRICAL | E001, E002, B-ED101, B-ED102, B-E101, B-E102, F-E101, FF-ED101, FF-ED102, FF-E101, FF-E102, H-ED101, H-E101 | Dated June 16, 2017 |

Prepared by Harper Perkins Architects Inc., 4724 Old Jacksboro Highway, Wichita Falls, Texas 76302-3599.

COMPLETION DATE: The Proposer acknowledges the anticipated time frame must be coordinated with the Construction Manager. Each sub-contractor must perform under construction schedule to benefit Midwestern State University. Provide total number of days required to complete your trade. Construction Manager will compile time and provide a schedule to be maintained.
Number of Days: _____

The undersigned propose to accomplish the following bid packages for the stated price:
(Bid Packages available thru the Construction Manager, M & F Litteken Company)

Base Proposal:

| Description of Scope | Amount Proposed | (Circle one) |
|---|---|---|
| Bid Package No. _____ | Amount $ _____ | (furnish, install turnkey) |
| Bid Package No. _____ | Amount $ _____ | (furnish, install turnkey) |
| Bid Package No. _____ | Amount $ _____ | (furnish, install turnkey) |
| Bid Package No. _____ | Amount $ _____ | (furnish, install turnkey) |
| Bid Package No. _____ | Amount $ _____ | (furnish, install turnkey) |
| Total Base Bid | Amount $_____ | |

LIQUIDATED DAMAGES: If the Contractor shall fail to fully complete the work within the time specified (subject however to extensions of time duly granted in the manner and for the cause specified in the GENERAL CONDITIONS) the Contractor shall be charged by the Owner as liquidated and ascertained damages the sum of Two Hundred Fifty Dollars ($250.00) per day for each calendar day that the work remains incomplete beyond the time fixed for the completion, it being hereby expressly and mutually agreed that from the nature of the case it would be impracticable and extremely difficult to fix the actual damage which would or will be suffered in the event that the Contractor should fail to fully complete the Work within the time specified, and it being further agreed that said charge herein provided for is reasonable and proper in the premises. The amount so charged may be deducted by the Owner from any money which might otherwise be or become payable to the Contractor.

SUBSTITUTIONS: The undersigned warrants to the Owner and the Architect by submitting this proposal, that he and all his suppliers and sub-contractors have used the items specified in the Project Manual and as indicated on the Drawings and that each has read and understands the paragraph entitled SUBSTITUTIONS in SECTION 01600 – PRODUCT REQUIREMENTS, in the Project Manual.

EXTRA WORK: The undersigned agrees that, should any change in the work, or extra work, be ordered, where the unit prices set out above are not applicable, the following applicable percentage shall be added to material land labor cost to cover overhead and profit. The contractor acknowledges that these percentages will be a determinant in the award of the contract.

A. Allowance of the Contractor for overhead and profit for extra work performed by the Contractor's own forces:

_____%

B. Allowances to the Contractor for overhead and profit for extra work performed by a sub-contractor and Supervised by the Contractor:

_____%

GUARANTEE: The undersigned furnish herewith guarantee total of base proposal lump sum amount and attaches same to the proposal for the period of sixty (60) days after the schedule closing time for the receipt of the proposals, and that if this proposal is accepted, the undersigned will enter into a formal contract (prepared by the Owner) and that the required performance bond and payment bond will be given. In the event of the withdrawal of this proposal within the period stipulated above, or the failure of the undersigned to enter into a contract and give the required bond within ten (10) days after the undersigned had received notice of the acceptance of this proposal, the undersigned shall be liable to the Owner for the full amount of the guarantee as liquidated damages to the Owner on account of the default of the undersigned.

WAGE SCALE: The undersigned acknowledges the Wage Scale as published in accordance with VCS 5159A and payment of wages in accordance with this scale and statutes are a condition of the contract.

ADDENDA: The undersigned hereby acknowledges receipt of the following listed Addenda to the Drawings and Specifications, all of the provisions and requirements of which Addenda have been taken into consideration in the preparation of the foregoing proposal.

_____

_____

_____

FELONY CONVICTION NOTICE

Senate Bill 1 passed by the State of Texas Legislators, Section 44.034, Notification of Criminal History Subsection (a) states a person or business entity that enters into a contract with a school district must give advance notice to the district if the person or owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony.

Subsection (b) states "a school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction. The district must compensate the person or business entity for services performed before the termination of the contract".

This notice is not required of a publicly held corporation.

I, the undersigned agent for the firm named below, certify that the information concerning notification of felony conviction has been reviewed by me and the following information furnished is true to the best of my knowledge.

Sub Contractor / Vendor's Name: _____

Authorized company Official's Name: (Please Print) _____

A. My firm is not owned by anyone who has been convicted of a felony nor listed as a sexual predator.

**Signature of Company Official**: _____

a. My firm is owned by individual(s) who has/have been convicted of a felony or listed as a sexual predator.

**Signature of Company Official**: _____

Felony: No____ Yes____ Details of Conviction: _____

Sexual Predator: No____ Yes____ Details of Conviction: _____

B. My firm employees the following individual(s) who has/have not been convicted of a felony or identified as a sexual predator. (Provide a complete list of all employees that will be associated with this project. Provide additional pages as required.)

**Signature of Company Official**: _____

- Name of Employee: _____

Felony: No____ Yes____ Details of Conviction: _____

Sexual Predator: No____ Yes____ Details of Conviction: _____

- Name of Employee: _____

Felony: No____ Yes____ Details of Conviction: _____

Sexual Predator: No____ Yes____ Details of Conviction: _____

CERTIFICATION SHEET

All specifications and terms of the Proposal have been read.

Our company accepts the specifications and conditions unless otherwise accepted in writing to the Purchasing Agent, Midwestern State University, 3410 Taft Blvd, Wichita Falls, Texas.

| | | |
|---|---|---|
| COMPANY NAME: | | |
| MAILING ADDRESS: | | |
| City: | State: | Zip: |
| Telephone: | Fax: | Date: |

NAME OF REPRESENTATIVE AUTHORIZED TO SIGN FOR BIDDER:

_____ _____
(Please Print) (Please Sign)

In order for a proposal to be considered, the following information must be provided. **Failure to complete will result in rejection of the Proposal.**

As defined by Texas House 620, a "nonresident bidder" means a bidder whose principal place of business is not in Texas, but excludes a contractor whose ultimate parent company or majority owner has its principal place of business in Texas.

I certify that my company is a "resident bidder":

**SIGNATURE:** _____ **DATE:** _____

IF YOU QUALIFY AS A "nonresident bidder", you must furnish the following information:

What is your resident state? (The state your principal place of business is located.)

_____ _____ _____
City State Zip Code

_____ _____
Name of Company Address

(a) Does your "residence state" require bidders whose principal place of business is in Texas to underbid bidders whose residence state is the same as yours by a prescribed amount or percentage to receive a comparable contract? "Residence state" means that state in which the principal place of business is located.

YES ☐ NO ☐

(b) What is that amount or percentage? _____%

I certify that the above information is correct.

_____ _____
Signature Title

_____
(Please Print Name)
This page must be completed and submitted with proposal.

Proposals are to be sent via email or hand delivered to:
Stephen Shelley, Director of Purchasing & Contract Management
3410 Taft Blvd, Daniel Building, Room 202
Wichita Falls, TX 76308
**Stephen.shelley@mwsu.edu**
940-397-4110

## PROPOSE TO PROVIDE AND STATEMENT OF NONCOLLUSION

I / we propose to provide the merchandise and/or services proposed within this document and if awarded the proposal, do agree to abide by all conditions of the proposal. Furthermore, the undersigned affirms that they are truly authorized to execute this contract, that this company, corporation, firm, partnership or individual has not prepared this proposal in collusion with any other Proposer, and that the contents of this proposal as to prices, terms or conditions of said proposal have not been communicated by the undersigned or any employee or agent to any other person engaged in this type of business prior to the official opening of this bid.

_____
Vendor Name

_____
Vendor Address

_____
Signature of Company Representative

_____
Printed Name of Company Representative

_____
Date

This page must be completed and submitted with proposal.

RESPECTFULLY SUBMITTED

CORPORATIONS ONLY FILL IN THE FOLLOWING:

_____
(Legal name of Corporation)

_____
(State of Incorporation)

_____
(Address)

_____
(Typed name of Officer)

_____
(Signature of Officer)

_____
(Title of Officer)

_____
(Date)

PROPOSERS (OTHER THAN CORPORATIONS) FILL IN THE FOLLOWING:

_____
(Legal name of Proposing Firm)

_____
(Address)

_____
(Typed name of Officer)

_____
(Signature of Officer)

_____
(Title of Officer)

_____
(Date)

WITNESS:

_____
(Name of Witness typed in)

_____
(Signature of Witness)

_____
(Address of Witness)

_____
(Date)

(Signature of Proposer, including corporation officer, must be witnessed and proposal dated to be valid)


AIA HPA
ARCHITECTS PROGRAMMERS PLANNERS

# STATUTORY PERFORMANCE BOND PURSUANT TO ARTICLE 5160 OF THE REVISED CIVIL STATUTES OF TEXAS AS AMENDED BY ACTS OF THE 56TH LEGISLATURE, 1959

## (McGregor Act - Public Works)

**(Penalty of this bond must be 100% of Contract amount)**

**KNOW ALL MEN BY THESE PRESENTS:**

**That,**

**.....**

**(hereinafter called the Principal), as Principal, and .....**

**a corporation organized and existing under the laws of the State of....., with its principal office in the City of ....., (hereinafter called the Surety), as Surety, are held and firmly bound unto**

**.....**

**(hereinafter called the Obligee) in the amount of .....**

**Dollars ($.....), for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally , firmly by these presents.**

**WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the ..... day of ....., 20 ....., to .....**

**which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.**

**NOW THEREFORE THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform the work in accordance with the plans, specifications and contract documents, then this obligation shall be void; otherwise to remain in full force and effect.**

**PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Article 5160 of the Revised Civil Statutes of Texas as amended by Acts of the 56th Legislature, 1959, and all liabilities on this bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copied at length herein.**

**IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this .....day of .....20 ..... .**

| | |
|---|---|
| **Witness:** | **..... (Seal)** |
| **.....** | **..... (Seal)** |
| **(If Individual or Firm)** | |
| **Attest:** | **..... (Seal)** |
| **.....** | **..... (Seal)** |
| **(If Corporation)** | **Principal** |
| | **.....** |
| | **Surety** |
| **.....** | **By ..... (Seal)** |


AIA HPA
ARCHITECTS PROGRAMMERS PLANNERS

# STATUTORY PAYMENT BOND PURSUANT TO ARTICLE 5160 OF THE REVISED CIVIL STATUTES OF TEXAS AS AMENDED BY ACTS OF THE 56TH LEGISLATURE, 1959

## (McGregor Act - Public Works)

**(Penalty of this bond must be 100% of Contract amount)**

**KNOW ALL MEN BY THESE PRESENTS:**

**That, ..... (hereinafter called the Principal), as Principal, and ....., a corporation organized and existing under the laws of the State of....., with its principal office in the City of ....., (hereinafter called the Surety), as Surety, are held and firmly bound unto ..... .**

**(hereinafter called the Obligee) in the amount of ..... .**

**Dollars ($.....), for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.**

**WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the ..... day of ....., 20 ....., to ..... .....**

**which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.**

**NOW THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall pay all claimants supplying labor and material to him or a subcontractor in the prosecution of the work provided for in said contract, then , this obligation shall be void; otherwise to remain in full force and effect.**

**PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Article 5160 of the Revised Civil Statutes of Texas as amended by Acts of the 56th Legislature, 1959, and all liabilities on this bond to all such claimants shall be determined in accordance with the provisions of said Article to the same extent as if it were copied at length herein.**

**IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this ..... day of .....20 ..... .**

**Witness:** **.....(Seal)**

**.....** **.....(Seal)**
**(If Individual or Firm)**

**Attest:** **..... (Seal)**

**.....** **..... (Seal)**
**(If Corporation)** **Principal**

**.....**
**Surety**

**.....By** **..... (Seal)**


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# Geotechnical Evaluation Report

Midwestern State University
New Stair Towers at Bolin Science Hall and Fain Fine Arts
2304 Midwestern Parkway
Wichita Falls, Texas

*Prepared for*

## Midwestern State University


Shane Nance, P.E.

Shane Nance, P.E.
Business Unit Manager – Senior Engineer
License Number: 81519
January 27, 2017

Project B1611833

Braun Intertec Corporation
TBPE Firm Registration No. F-12228

BRAUN INTERTEC
The Science You Build On.

**Braun Intertec Corporation**
215 South Fannin St.
Amarillo, TX 79106

Phone: 806.677.0600
Web: braunintertec.com

January 27, 2017 Project B1611833

Midwestern State University
c/o Mr. Sam Kenshalo
Harper Perkins Architects, Inc.
4724 Old Jackson Hwy.
Wichita Falls, TX 76302
940.767.1421
skenshalo@harperperkins.com

Re: Geotechnical Evaluation
Midwestern State University - New Stair Towers at Bolin Science Hall and Fain Fine Arts
2304 Midwestern Parkway
Wichita Falls, Texas

Dear Mr. Kenshalo:

We are pleased to present this Geotechnical Evaluation Report for the referenced site.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report or if there are other services that we can provide in support of our work to date please contact Shane Nance at 806.677.0600 (snance@braunintertec.com).

Sincerely,

BRAUN INTERTEC CORPORATION
TBPE Firm Registration No. F-12228

Shane Nance, P.E.
Business Unit Manager – Senior Engineer

Randy Deatherage, P.E.
Project Engineer

# Table of Contents

**Description** **Page**

**Appendix**
Soil Boring Location Sketch
Log of Boring Sheets SB-1 through SB-2
Descriptive Terminology of Soil

# A. Introduction

## A.1. Project Description

This Geotechnical Evaluation Report addresses the design and construction of the proposed stair towers at Midwestern State University (MSU) Bolin Science Hall and Fain Fine Arts building. The site is located at 2304 Midwestern Parkway in Wichita Walls, TX. Figure 1 below shows an illustration of the proposed site locations.

**Figure 1. Site Location**


Figure provided by Google Earth.

## A.2. Purpose

The purpose of our geotechnical evaluation will be to characterize subsurface geologic conditions at selected exploration locations and evaluate their impact on the design and construction of the project.

## A.3. Scope of Services

We performed our scope of services for the project in accordance with our Proposal QTB049838 to MSU, dated December 9, 2016, and authorized on December 15, 2016 (MSU Purchase Agreement P11817). The following list describes the geotechnical tasks completed in accordance with our authorized scope of services.

- Coordinating the staking and clearing the exploration location of underground utilities. Harper Perkins Architects, Inc. selected and we staked the exploration locations using handheld GPS technology. The Soil Boring Location Sketch included in the Appendix shows the approximate locations of the borings.

- Performing 2 soil borings, denoted as SB-1 to SB-2, to nominal depths of 39.5 feet below existing grade.

- Performing semi-continuous sampling to a depth of 10 feet, and at 5-foot intervals at greater depths in general accordance with American Society for Testing and Materials (ASTM) D1586 and ASTM D1587.

- Performing laboratory testing on select samples to aid in soil classification and engineering analysis.

- Perform engineering analysis including estimation of potential vertical rises and foundation bearing capacity analysis.

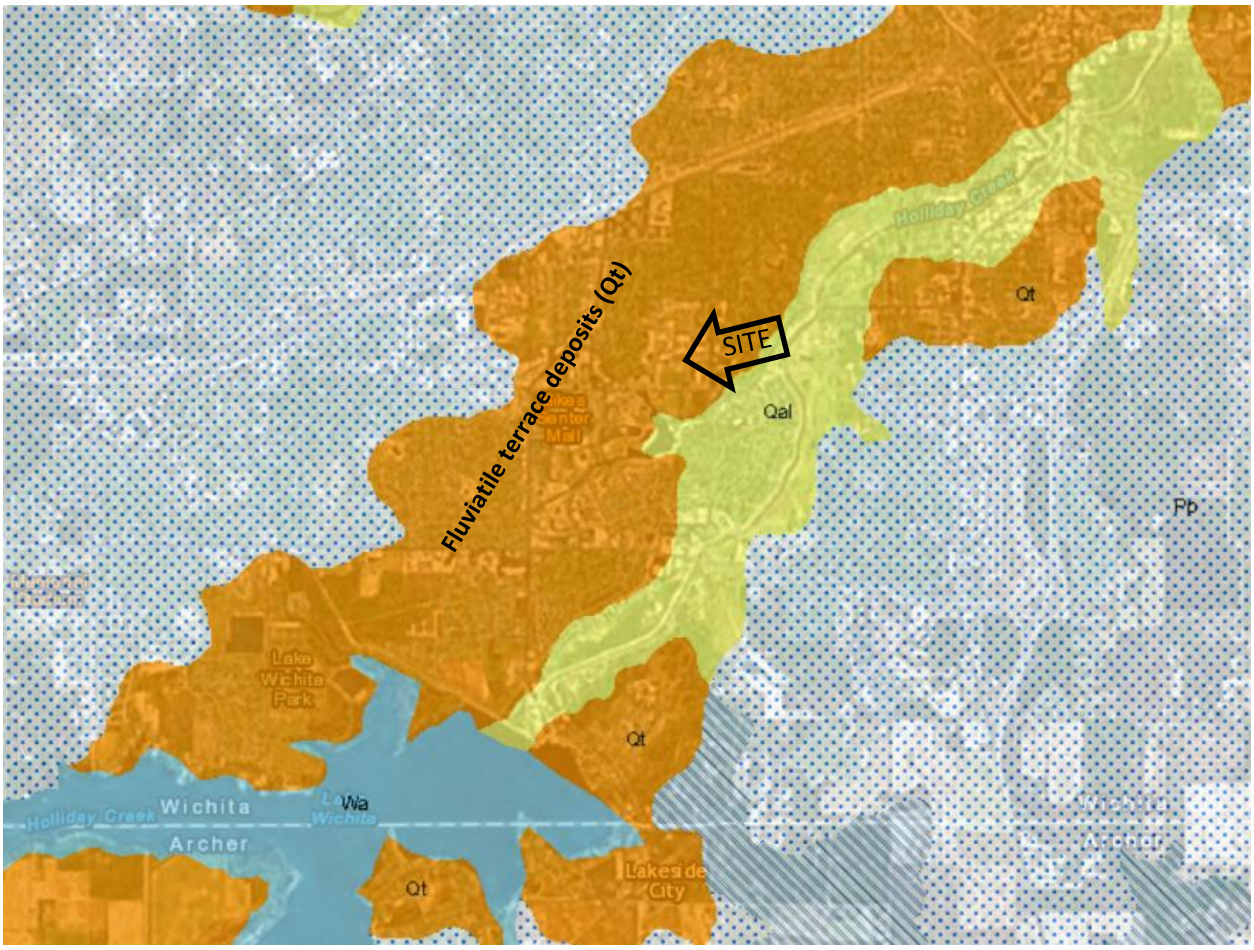
- Preparing this report containing the findings of our field exploration, laboratory testing and engineering recommendations.

# B. Results

## B.1. Geologic Overview

Based upon our review of available geologic resources, the site is underlain by the Fluviatile terrace deposits (Qt). The deposits are silty, sandy, and clayey, brownish red, bedded and lenticular with buried soils. Upper terrace levels are covered by veneer of windblown sand and silt.

**Figure 2. Geologic Map**




**(http://txpub.usgs.gov/DSS/texasgeology)**

We based the geologic origins used in this report on the soil types and available common knowledge of the geological history of the site. We did not perform a detailed investigation of the geologic history for the site.

## B.2. Groundwater

Groundwater was observed at 20 feet below existing grade while advancing the borings. The attached Log of Boring sheets in the Appendix also include this information.

## B.3. Laboratory Test Results

The boring logs show the results of Moisture Content (ASTM D2216), Atterberg Limits (ASTM D4318), and Percent Finer than No. 200 sieve (ASTM D1140) tests we performed, next to the tested sample depth. We performed the tests in general accordance with ASTM procedures. The Appendix contains the results of these tests.

The moisture content of the tested samples varied from approximately 8 to 20 percent. Liquid limits determined for the soils ranged from 25 to 50; plasticity index values ranged from 7 to 29.

# C. Recommendations

Based on the results of our subsurface exploration, the on-site soils exhibit low to medium expansive potential. The Potential Vertical Rise (PVR) was estimated for the site to be less than 1 inch using Texas Department of Transportation method (Test Procedure TEX-124-E). Refer to the following text for site grading and subgrade preparations, and foundation design recommendations.

## C.1. Site Grading and Subgrade Preparation

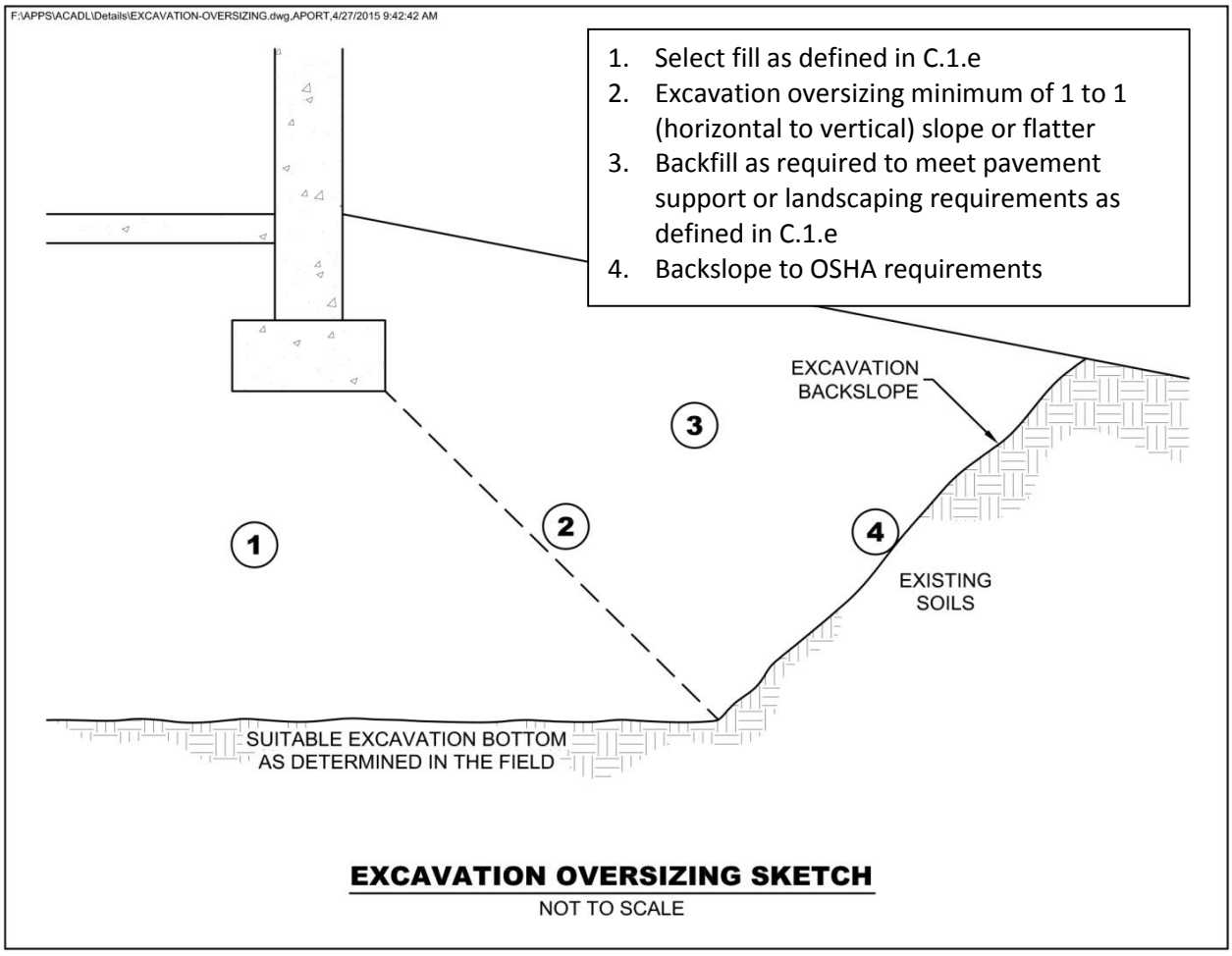
### C.1.a. Building Subgrade Preparation

We recommend removing vegetation, loose topsoil, construction debris and other deleterious material from the building pad area. Once complete, the subgrade soils should be scarified to a minimum depth of 6 inches, and recompacted to 95% Standard Proctor Density (ASTM D698), at -1% to +3% of optimum moisture. After preparing the subgrade, we recommend proof-rolling the subgrade soil as described in section C.1.d.

### C.1.b. Excavation Oversizing

When removing materials below structures, we recommend the excavation extend outward and downward at a slope of 1H:1V (horizontal:vertical) or flatter. See Figure 3 for an illustration of excavation oversizing.

**Figure 3. Generalized Illustration of Oversizing**




### C.1.c. Excavated Slopes

Based on the borings, we anticipate on-site soils in excavations will consist of silty clayey sand and silty sand. These soils are typically considered Type B Soil under OSHA (Occupational Safety and Health Administration) guidelines. OSHA guidelines indicate unsupported excavations in Type B soils should have a gradient no steeper than 1H:1V (45°). Slopes constructed in this manner may still exhibit surface sloughing. OSHA requires an engineer to evaluate slopes or excavations over 20 feet in depth.

An OSHA-approved qualified person should review the soil classification in the field. Excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, “Excavations and Trenches”. This document states excavation safety is the responsibility of the contractor. The project specifications should reference these OSHA requirements.

### C.1.d. Subgrade Proof Roll

After preparing the subgrade as described above and prior to the placement of fill material, we recommend proof rolling the subgrade soils in accordance with Texas Department of Transportation (TxDOT) Standard Specification Item 216. We also recommend having a geotechnical representative observe the proof roll. Areas that fail the proof roll likely indicate soft or weak areas that will require additional soil correction work to support the structures.

The contractor should correct areas that display yielding or rutting. Possible options for subgrade correction include moisture conditioning and recompaction, excavation and replacement with soil or crushed aggregate, chemical stabilization and/or geotextiles. We recommend performing a second proof roll after the fill material is in place, and prior to constructing the foundations, or prior to placing asphalt or concrete pavement.

### C.1.e. Fill Materials and Compaction

Table 1 below contains our recommendations for fill materials.

**Table 1. Fill Materials**

| Locations To Be Used | Fill Classification | Possible Soil Type Descriptions | Gradation | Additional Requirements |
|---|---|---|---|---|
| Below Foundation and Pavement | Select fill | SC, CL | 1. 100% passing 3-inch sieve<br>2. 70% maximum passing No. 200 sieve | 1. Liquid Limit <35<br>2. Plasticity Index between 7 and 18<br>3. < 2% Organic Content |
| Below landscaped surfaces, where subsidence is not a concern | Non-select fill | -- | 100% passing 6-inch sieve | < 10% OC |

We recommend spreading fill/existing soil in loose lifts of approximately 8 inches thick and compacting the soils in accordance with the criteria presented below in Table 2. The project documents should specify compaction specification of fill, based on the structure located above the fill, and vertical proximity to that structure.

**Table 2. Compaction Recommendations Summary**

| Reference | Recommended Compaction, percent (ASTM D698 – Standard Proctor) | Moisture Content Variance from Optimum, percentage points |
|---|---|---|
| Native soils below foundations, pavement and oversizing zone | 95 | -1 to +3 |
| Select fill soils below foundations, pavement and oversizing zones | 95 | -1 to +3 |
| Below landscaped surfaces | 90 | -1 to +3 |

We recommend performing density tests in fill to evaluate if the contractors are effectively compacting the soil and meeting project requirements.

### C.1.f. Inspections of Soils

We recommend including the site grading and placement of fill within the building pad under the direction of a licensed Geotechnical Engineer. Inspection requires observation of soil conditions below fill or footings, evaluations to determine if excavations extend to the anticipated soils, and if fill materials meet requirements for type of fill and compaction condition of fill. A licensed geotechnical engineer should direct the inspections of site grading and fill placement. The purpose of these inspections is to evaluate whether the work is in accordance with the approved Geotechnical Report for the project. Special inspections should include evaluation of the subgrade, observing preparation of the subgrade (surface compaction or dewatering, excavation oversizing, placement procedures and materials used for fill, etc.) and compaction testing of the fill.

## C.2. Drilled Straight Shaft Piers

### C.2.a. Soil Parameters for the Design of Drilled Straight Shaft Piers

We have provided recommended soil parameters for the design of drilled straight shaft pier foundations in Table 3. Within the table, we provide parameters for both axial and lateral design.

**Table 3. Recommended Drilled Straight Shaft Pier Design Parameters**

| Design Parameter | Design Value | Remarks |
|---|---|---|
| Minimum Bearing Depth | 25 feet | Below existing grade at the time of field activities. |
| Net Allowable Bearing Pressures | 8,000 psf | Factor of Safety = 3.0 |
| Skin Friction, in compression | 500 psf | Factor of Safety = 2.0 |
| Skin Friction, in tension | 350 psf | Factor of Safety = 3.0 |
| Allowable Lateral Soil Bearing Pressure | 1,500 psf | Factor of Safety = 3.0 |
| Minimum Pier Spacing | Two (2) base diameters | Measured center-to-center |

**NOTES:**
1. Minimum diameter for inspection purposes is 18 inches.

### C.2.b. Drilled Straight Shaft Pier Construction Considerations

We recommend installing the shafts in general accordance with the most current American Concrete Institute's (ACI) "ACI 336.1. Standard Specification for the Construction of Drilled Piers." Presented below are a few specific recommendations.

1. Drilled shaft excavations should be inspected for verticality and side sloughing. Verticality is specified at one inch in ten feet of the shaft length, and should be checked to the full depth of dry augering prior to introducing drilling mud.

2. Before placing concrete, the shaft bottom should be cleaned out with a drilling bucket in order to remove any sediments that may not be displaced by the concrete. The shaft bottoms should be cleaned with a "clean-out" bucket until rotation on the bottom without crowd (i.e. penetration under force) produces little spoil. Probing after clean out is essential to verify the condition of the base of the shaft.

3. Concrete placement should be accomplished as directed in ACI 336.1. The tremie pipe diameter should be at least eight times as large as the largest concrete aggregate size (if used).

4. A computation of the final concrete volume for each shaft should be made. Shafts taking an unreasonably high or low volume of concrete should be cored to check their integrity.

5. Temporary casing and/or slurry may be needed to prevent groundwater and caving in. If temporary casing is used, the level of concrete within the casing should be maintained well above the casing bottom prior to and during extraction. The casing should be extracted slowly and smoothly with a vibratory hammer without rotation. Our analyses assume no casing will be left in place. We should be informed if casing will be left in place so we may provide revised shaft capacity calculations.

6. Shaft excavations should not be made within three shaft diameters (edge to edge) of shafts that have been concreted within the last 24 hours.

7. We recommend having the drilled pier contractor review this report prior to construction to determine whether or not casing or specialized equipment might be necessary.

## C.3. Structural Floor Slab

If floor slab movement cannot be tolerated, a floor system structurally suspended above the subgrade is recommended. Such a system is one method of assuring the absence of distress due to subgrade movement. At this site, a minimum void space of 6 inches is recommended beneath the slabs.

The minimum void space can be provided by the use of cardboard carton forms, or a deeper crawl space. The bottom of the void should preferably be higher than adjacent exterior grades. A ventilated and drained crawl space is preferred for several reasons, including the following:

- Ground movements will affect the project utilities, which can cause breaks in the lines and distress to interior fixtures.

- A crawl space permits utilities to be hung from the superstructure, which greatly reduces the possibility of distress due to ground movements. It also can provide ready access in the event repairs are necessary.

- Ground movements are uneven. A crawl space can be positively drained preventing the ponding of water and reducing the possibility of distress due to unexpected ground movements.

### C.3.a. Grade Beams/Pier Caps

All grade beams or wall panels should then be supported by drilled shafts. A minimum void space of 6 inches is recommended between the bottom of grade beams, pier cap extensions, or wall panels and the subgrade. This void will serve to minimize distress resulting from swell pressures generated by the clays. Structural cardboard forms are one acceptable means of providing this void beneath cast-in-place elements. Soil retainers should be used to help prevent the filling of the void with soil.

The grade beams should be formed rather than cast against earth trenches. Backfill against the exterior face of grade beams or wall panels should be properly compacted onsite clays. Compaction should be a minimum of 92 percent of ASTM D698, at a minimum of +1 percent above the optimum moisture content determined by that test.

### C.3.b. Below Grade Construction

Below-grade construction will involve excavations, and below grade walls and slabs.

**Excavations.** Finished floor elevations are not known at this time. We assume excavations up to depths of 10 to 15 feet. Based on the subsurface conditions encountered in the borings, excavations will generally encounter clayey sands and lean clays.

The soils can be excavated with standard earthwork equipment. These soils will need to be properly sloped or braced during construction to maintain support. Applicable OSHA standards should be followed. Consideration should also be given to erosion protection on exposed slopes.

Groundwater seepage was observed in the borings, and could be encountered during excavation, particularly if construction proceeds during a wet period of the year. Dewatering may be necessary if significant seepage occurs in the excavation. This can normally be handled during construction by trenches and sump pumps.

A soft pumping subgrade may be present due to groundwater. Geotextiles in conjunction with base materials could be required to establish a working platform for equipment.

**Below Grade Walls/Retaining Walls.** Below grade walls should be supported by drilled shafts as previously recommended.

Lateral earth pressures acting on the walls will depend on the type of backfill material used and drainage conditions behind the wall. Recommended lateral earth pressures expressed as equivalent fluid pressures are presented below for rigid and flexible walls. Rigid walls are not anticipated to deflect

sufficiently to mobilize active earth pressures. Structure walls should be considered rigid. Active earth pressures can be used where the top of the wall will deflect on the order of 0.5 percent of the wall height.

Select or granular backfill should extend outward at least 3 feet from the base of the wall and then upward on a 1H:1V slope. For narrower backfill widths of select or granular soils, the equivalent fluid pressures for the on-site soils should be used.

The lateral earth pressure values do not include surcharge loads due to overburden, traffic, equipment, etc. Surcharge loads should be considered if they apply at the surface above the wall within areas defined by an angle of 45 degrees from the base of the wall. A lateral pressure coefficient of 0.5 is recommended for uniformly distributed surcharge loads.

Wall backfill materials should be placed in loose lifts, less than 9 inches thick, and uniformly compacted to a minimum density of 95 percent of ASTM D698. Moisture content during placement of cohesive backfill should be within 0 to +5 percent of the optimum moisture content as measured in test method ASTM D698. Granular backfill should not be water jetted to achieve compaction and should be placed at a moisture content to allow the desired density to be achieved.

**Table 4. Equivalent Fluid Pressures**

| Backfill Type | Equivalent Fluid Pressure | |
|---|---|---|
| | At-Rest | Active |
| On-site soils | 100 pcf | 85 pcf |
| Select Fill | 65 pcf | 50 pcf |
| Granular backfill | 55 pcf | 35 pcf |

The three types of wall backfill materials which can be used are as follows:

1) On-Site Backfill – The on-site backfill includes all on-site lean clay and clayey sand materials. The soil should be free of organic matter and rock fragments greater than 4 inches in diameter.

2) Select Fill Backfill – Select fill material used as backfill should be a very sandy clay or clayey sand with a liquid limit of less than 35 percent. The plasticity index of this material should be between 7 and 15.

3) Granular Backfill – The granular free draining backfill materials should be a crushed stone, sand/gravel mixture, or sand/crushed stone mixture. The material should have less than 3 percent passing the No. 200 sieve and less than 30 percent passing the No. 40 sieve. The minus No. 40 sieve materials should be non-plastic. The granular soil should have a friction angle of at least 34 degrees.

Care should be taken that backfill is not overcompacted, which could increase the lateral pressures on the walls. The top of the backfill should be protected by flatwork, paving or for granular backfill a minimum of 2 feet of clay fill to prevent surface infiltration.

The design recommendations presented above assume hydrostatic pressures will not develop behind the wall. For structure walls, the drains should be a minimum of 12 inches lower than the adjacent slab. Drainage for free standing walls can be provided by using a collector pipe or weep holes near the base of the wall. Drains should be properly filtered to minimize the potential for erosion through these drains and/or plugging of drain lines.

Settlement of the wall backfill should be anticipated. Piping and conduits through the fill should be designed for potential soil loading due to fill settlement. Flatwork, sidewalks and pavements over fills may also settle. Backfill compacted to the density recommended above is anticipated to settle on the order of one to two percent of the fill thickness.

**Below-Grade Floor Slabs.** The finished floor elevation of the elevator pit is assumed to be about 10 to 15 feet below existing grade. Excavations for the pit will remove some of the active soils. Potential movements of slabs-on-grade placed about 10 to 15 feet below existing grade are estimated to be less than 1 inch. If this level of movement can be tolerated, slabs-on-grade may be placed directly on in-situ soils. If less movement is desired, consideration should be given to a structural floor slab.

**Sub-Floor Drainage Systems.** A sub-floor drainage system is recommended beneath any below-grade areas with finished space. A vapor retarder is also recommended for floors that will receive floor coverings with water based adhesives.

Most elevator pit slabs are not considered particularly sensitive to occasional wet spots. If this is the case, it is considered reasonable to omit the sub-floor drains and rely on the perimeter drainage system to intercept the seepage. Groundwater observations during construction could indicate that sub-drains are warranted. Braun Intertec should be contacted if groundwater seepage is observed during construction.

Where installed, sub-floor drains should be situated a minimum of 12 inches lower than the bottom of the slab. This can be accomplished by placing collector drains in shallow trenches connected by a uniform surface drainage layer at least 6 inches thick. A filter fabric should be used to separate the drainage material from soil subgrades.

## C.4. Utilities

### C.4.a. Subgrade Stabilization

Earthwork activities associated with utility installations located inside the building footprint should adhere to the recommendations in Section C.1.

For exterior utilities, we anticipate the soils at typical invert elevations will be suitable for utility support. However, if construction encounters unfavorable conditions, the unsuitable soils may require some additional subcutting and replacement with sand or crushed rock to prepare a proper subgrade for pipe support. Project design and construction should not place utilities within the 1H:1V oversizing of foundations.

## C.5. Equipment Support

The recommendations included in the report may not be applicable to equipment used for the construction and maintenance of this project. We recommend evaluating subgrade conditions in areas of shoring, scaffolding, cranes, pumps, lifts and other construction equipment prior to mobilization to determine if the exposed materials are suitable for equipment support, or require some form of subgrade improvement. We also recommend project planning consider the effect that loads applied by such equipment may have on structures they bear on or surcharge – including pavements, buried utilities, below-grade walls, etc. We can assist you in this evaluation.

## C.6. Seismic Site Classification

Due to project budget limitation, we did not perform a 100-foot deep boring recommended in the International Building Code (IBC) for seismic site classification. We conservatively assumed the overburden soil consistency continues below the bottom of the borings. Based on the soil boring data and pertinent reference materials, this site meets the criteria for Site Class D as defined in Table 1613.5.2 of Chapter 16 of the 2015 IBC.

# D. Procedures

## D.1. Test Borings

We drilled the borings with a truck-mounted auger drill. We performed the borings in general accordance with ASTM D1586 and ASTM D1587 taking samples semi-continuously to a depth of 10 feet and then 5-foot intervals thereafter. The boring logs show the actual sample intervals and corresponding depths.

## D.2. Exploration Logs

The Appendix includes Log of Boring sheets for our test borings. The logs identify and describe the penetrated geologic materials, and present the results of penetration resistance and other in-situ tests performed. The logs also present the results of laboratory tests performed on test samples, and groundwater measurements.

We inferred strata boundaries from changes in the test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may occur as gradual rather than abrupt transitions.

## D.3. Material Classification and Testing

### D.3.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered in accordance with ASTM D2488. The Appendix includes a chart explaining the classification system.

### D.3.b. Laboratory Testing

The exploration logs in the Appendix note most of the results of the laboratory tests performed on geologic material samples. The remaining laboratory test results follow the exploration logs. We performed the tests in general accordance with ASTM or AASHTO procedures.

## D.4. Groundwater Measurements

The drillers checked for groundwater while advancing the test borings, and again after auger withdrawal. We then filled the boreholes as noted on the boring logs.

# E. Qualifications

## E.1. Variations in Subsurface Conditions

### E.1.a. Material Strata

We developed our evaluation, analyses and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work, or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations. Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

### E.1.b. Groundwater Levels

We made groundwater measurements under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

## E.2. Continuity of Professional Responsibility

### E.2.a. Plan Review

We based this report on a limited amount of information, and we made a number of assumptions to help us develop our recommendations. We should be retained to review the geotechnical aspects of the designs and specifications. This review will allow us to evaluate whether we anticipated the design correctly, if any design changes affect the validity of our recommendations, and if the design and specifications correctly interpret and implement our recommendations.

### E.2.b. Construction Observations and Testing

We recommend retaining us to perform the required observations and testing during construction as part of the ongoing geotechnical evaluation. This will allow us to correlate the subsurface conditions exposed during construction with those encountered by the borings and provide professional continuity from the

design phase to the construction phase. If we do not perform observations and testing during construction, it becomes the responsibility of others to validate the assumption made during the preparation of this report and to accept the construction-related geotechnical engineer-of-record responsibilities.

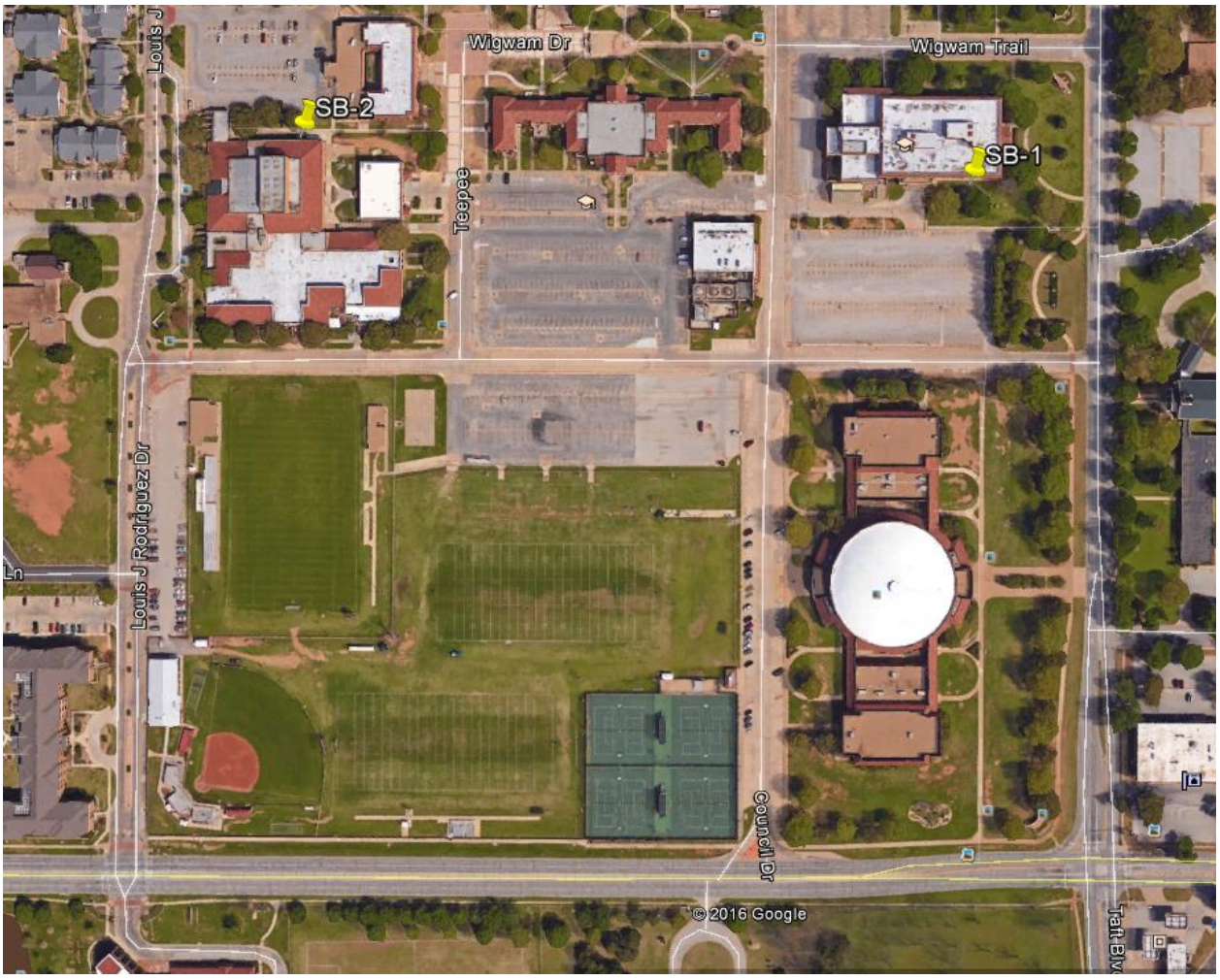
## E.3. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

## E.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

# Appendix




| PLAN OF BORINGS | |
|---|---|
| **BRAUN INTERTEC CORPORATION PROJECT NO.:** B1611833 | **MSU – Stair Towers at Bolin Science Hall and Fain Fine Arts Building**<br>**2304 Midwestern Parkway**<br>**Wichita Falls, TX** |
| **DATE DRILLED:** December 20, 2016 | |
| **SCALE:** Not to Scale | |

BRAUN INTERTEC

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1611833**
**Geotechnical Evaluation**
**MSU Bolin Science Hall & Fain Fine Arts New Stair Tower**
**2304 Midwestern Parkway**
**Wichita Falls, Texas**

BORING: **SB-1**

LOCATION: See Attached Sketch

DRILLER: B. Faulkner | METHOD: Solid Stem Auger | DATE: **12/20/16** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Depth feet | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 0.0 | CL-ML | SANDY SILTY CLAY, reddish brown, medium stiff | 6 | | 10 | | |
| | | - very stiff at 3 ft | 17 | | 8 | 67 | LL=25 PL=18 PI=7 |
| 5.0 | CL | LEAN CLAY with SAND, brown, stiff | 13 | | 10 | | |
| 8.0 | SC | CLAYEY SAND, red, medium dense | 10 | | 16 | | LL=33 PL=16 PI=17 |
| | | - loose at 13 ft | 7 | | 18 | | |
| | | - dense at 18 ft | 37 | ▽ | 13 | | |
| | | | 30 | | 16 | 48 | LL=39 PL=18 PI=21 |
| 28.0 | CL | LEAN CLAY, red to gray, hard | 91 | | 15 | | |

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1611833**
**Geotechnical Evaluation**
**MSU Bolin Science Hall & Fain Fine Arts New Stair Tower**
**2304 Midwestern Parkway**
**Wichita Falls, Texas**

BORING: **SB-1 (cont.)**
LOCATION: See Attached Sketch

DRILLER: B. Faulkner | METHOD: Solid Stem Auger | DATE: **12/20/16** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Depth feet | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 32.0 | | LEAN CLAY, red to gray, hard *(continued)* | | | | | |
| | | | 50+ | | 20 | | |
| 39.0 | | | 50+ | | 16 | 89 | LL=49 PL=20 PI=29 |
| | | END OF BORING | | | | | |
| | | Water observed at a depth of 20 feet while drilling. | | | | | |
| | | Boring immediately backfilled. | | | | | |
| | | An open triangle in the water level (WL) column indicates the depth at which groundwater was first observed while drilling. | | | | | |

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1611833**
**Geotechnical Evaluation**
**MSU Bolin Science Hall & Fain Fine Arts New Stair Tower**
**2304 Midwestern Parkway**
**Wichita Falls, Texas**

BORING: **SB-2**

LOCATION: See Attached Sketch

DRILLER: B. Faulkner | METHOD: Solid Stem Auger | DATE: **12/20/16** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Depth feet | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 0.0 | CL | LEAN CLAY with SAND, reddish brown, stiff | 8 | | 14 | 74 | LL=34 PL=15 PI=19 |
| | | | 11 | | 11 | | |
| 5.0 | CL | LEAN CLAY with SAND, brown, stiff | 13 | | 12 | 82 | LL=40 PL=19 PI=21 |
| 8.0 | SC | LEAN CLAY with SAND, red, medium stiff | 6 | | 16 | 84 | LL=36 PL=15 PI=21 |
| | | | 5 | | 14 | | |
| 18.0 | CL | SANDY LEAN CLAY, red, stiff | 11 | ▽ | 18 | 65 | LL=30 PL=16 PI=14 |
| | | - very stiff at 23 ft | 27 | | 16 | | |
| 28.0 | CL | FAT CLAY with SAND, red to gray, hard | 45 | | 16 | | |

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1611833**
**Geotechnical Evaluation**
**MSU Bolin Science Hall & Fain Fine Arts New Stair Tower**
**2304 Midwestern Parkway**
**Wichita Falls, Texas**

BORING: **SB-2 (cont.)**
LOCATION: See Attached Sketch

DRILLER: B. Faulkner | METHOD: Solid Stem Auger | DATE: **12/20/16** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Depth feet | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 32.0 | | FAT CLAY with SAND, red to gray, hard *(continued)* | | | | | |
| | | | 50 | | 18 | 81 | LL=50 PL=26 PI=24 |
| 39.1 | | | 50+ | | 15 | | |
| | | END OF BORING | | | | | |
| | | Water observed at a depth of 20 feet while drilling. | | | | | |
| | | Boring immediately backfilled. | | | | | |
| | | An open triangle in the water level (WL) column indicates the depth at which groundwater was first observed while drilling. | | | | | |

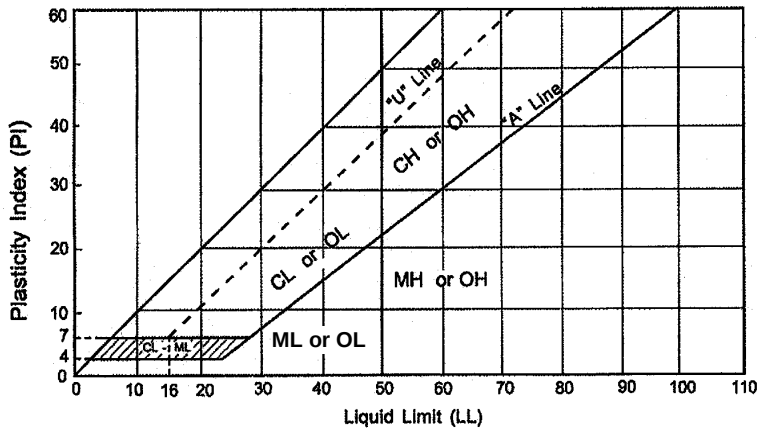
BRAUN INTERTEC

# Descriptive Terminology of Soil

Standard D 2487
Classification of Soils for Engineering Purposes
(Unified Soil Classification System)

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [a] | | | | Soils Classification | |
|---|---|---|---|---|---|
| | | | | Group Symbol | Group Name [b] |
| Coarse-grained Soils more than 50% retained on No. 200 sieve | Gravels More than 50% of coarse fraction retained on No. 4 sieve | Clean Gravels Less than 5% fines [e] | $C_u \geq 4$ and $1 \leq C_c \leq 3$ [c] | GW | Well-graded gravel [d] |
| | | | $C_u < 4$ and/or $1 > C_c > 3$ [c] | GP | Poorly graded gravel [d] |
| | | Gravels with Fines More than 12% fines [e] | Fines classify as ML or MH | GM | Silty gravel [d f g] |
| | | | Fines classify as CL or CH | GC | Clayey gravel [d f g] |
| | Sands 50% or more of coarse fraction passes No. 4 sieve | Clean Sands Less than 5% fines [i] | $C_u \geq 6$ and $1 \leq C_c \leq 3$ [c] | SW | Well-graded sand [h] |
| | | | $C_u < 6$ and/or $1 > C_c > 3$ [c] | SP | Poorly graded sand [h] |
| | | Sands with Fines More than 12% [i] | Fines classify as ML or MH | SM | Silty sand [f g h] |
| | | | Fines classify as CL or CH | SC | Clayey sand [f g h] |
| Fine-grained Soils 50% or more passed the No. 200 sieve | Silts and Clays Liquid limit less than 50 | Inorganic | PI > 7 and plots on or above "A" line [j] | CL | Lean clay [k l m] |
| | | | PI < 4 or plots below "A" line [j] | ML | Silt [k l m] |
| | | Organic | Liquid limit - oven dried / Liquid limit - not dried < 0.75 | OL | Organic clay [k l m n] |
| | | | | OL | Organic silt [k l m o] |
| | Silts and clays Liquid limit 50 or more | Inorganic | PI plots on or above "A" line | CH | Fat clay [k l m] |
| | | | PI plots below "A" line | MH | Elastic silt [k l m] |
| | | Organic | Liquid limit - oven dried / Liquid limit - not dried < 0.75 | OH | Organic clay [k l m p] |
| | | | | OH | Organic silt [k l m q] |
| Highly Organic Soils | Primarily organic matter, dark in color and organic odor | | | PT | Peat |

a. Based on the material passing the 3-inch (75mm) sieve.
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60}/D_{10}$ $C_c = \frac{(D30)^2}{D_{10} \times D_{60}}$
d. If soil contains ≥15% sand, add "with sand" to group name.
e. Gravels with 5 to 12% fines require dual symbols:
   GW-GM well-graded gravel with silt
   GW-GC well-graded gravel with clay
   GP-GM poorly graded gravel with silt
   GP-GC poorly graded gravel with clay
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines: to group name.
h. If soil contains ≥15% gravel, add "with gravel" to group name.
i. Sand with 5 to 12% fines require dual symbols:
   SW-SM well-graded sand with silt
   SW-SC well-graded sand with clay
   SP-SM poorly graded sand with silt
   SP-SC poorly graded sand with clay
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 10 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line.
p. PI plots on or above "A" lines.
q. PI plots below "A" line.




## Laboratory Tests

| | | | |
|---|---|---|---|
| **DD** | Dry density, pcf | **OC** | Organic content, % |
| **WD** | Wet density, pcg | **S** | Percent of saturation, % |
| **MC** | Natural moisture content, % | **SG** | Specific gravity |
| **LL** | Liquid limit, % | **C** | Cohesion, psf |
| **PL** | Plastic limits, % | **Ø** | Angle of internal friction |
| **PI** | Plasticity index, % | **qu** | Unconfined compressive strength, psf |
| **P200** | % passing 200 sieve | **qp** | Pocket penetrometer strength, tsf |

## Particle Size Identification

| | |
|---|---|
| Boulders | over 12" |
| Cobbles | 3" to 12" |
| Gravel | |
| Coarse | 3/4" to 3" |
| Fine | No. 4 to 3/4" |
| Sand | |
| Coarse | No. 4 to No. 10 |
| Medium | No. 10 to No. 40 |
| Fine | No. 40 to No. 200 |
| Silt | <No. 200, PI< 4 or below "A" line |
| Clay | <No. 200, PI ≥ 4 and on or about "A" line |

## Relative Density of Cohesionless Soils

| | |
|---|---|
| Very Loose | 0 to 4 BPF |
| Loose | 5 to 10 BPF |
| Medium dense | 11 to 30 PPF |
| Dense | 31 to 50 BPF |
| Very dense | over 50 BPF |

## Consistency of Cohesive Soils

| | |
|---|---|
| Very soft | 0 to 1 BPF |
| Soft | 2 to 3 BPF |
| Rather soft | 4 to 5 BPF |
| Medium | 6 to 8 BPF |
| Rather stiff | 9 to 12 BPF |
| Stiff | 13 to 16 BPF |
| Very stiff | 17 to 30 BPF |
| Hard | over 30 BPF |

## Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers, unless noted otherwise. Jetting water was used to clean out auger prior to sampling only where indicated on logs. All samples were taken with the standard 2" OD split-tube samples, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous flight, solid-stern augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface, and are therefore, somewhat approximate.

Hand auger borings were advanced manually with a 1 1/2" or 3 1/4" diameter auger and were limited to the depth from which the auger could be manually withdrawn.

**BPF:** Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments, and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

**WH:** WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

**WR:** WR indicates the sampler penetrated soil under weight of rods alone; hammer weight, and driving not required.

**TW:** TW indicates thin-walled (undisturbed) tube sample.

**Note:** All tests were run in general accordance with applicable ASTM standards.

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# SUPPLEMENTARY GENERAL CONDITIONS

THE "GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION", “UNIFORM GENERAL CONDITIONS” 2005 EDITION AS PUBLISHED BY THE STATE OF TEXAS, INCLUSIVE ARE HEREBY MADE A PART OF THESE SPECIFICATIONS THE SAME AS IF REPRODUCED HERE IN FULL EXCEPT AS MODIFIED, RESCINDED OR SUPPLEMENTED BY THESE SUPPLEMENTARY GENERAL CONDITIONS, WHICH TAKE PRECEDENCE. THOSE PORTIONS OF THE GENERAL CONDITIONS WHICH ARE NOT ALTERED BY THESE SUPPLEMENTARY GENERAL CONDITIONS SHALL REMAINING EFFECT AS PUBLISHED.

ARTICLE 1 – DEFINITIONS:

1.1 ARCHITECT/ENGINEER: Shall refer to Harper Perkins Architects, Inc., located at 4724 Old Jacksboro Highway, Wichita Falls, Texas 76302; Phone Number: 940-767-1421; Project Architect: Glenda Ramsey, gramsey@harperperkins.com; Project Manager: Sam Kenshalo, skenshalo@harperperkins.com.

1.9 CONTRACTOR: The Contractor is the CMaR, M & F Litteken Company, located at 1803 East Scott Street, Wichita Falls, Texas 76301; Phone Number: 940-766-4442; Email: Kevin Darnell, kevin@mflitteken.com.

ARTICLE 2 – LAWS GOVERNING CONSTRUCTION

2.2 WAGE RATES: The Wage Rates Determination is included in the Project Manual.

ARTICLE 3 – GENERAL RESPONSIBILITIES OF OWNERS AND CONTRACTORS

3.1.1.1 PRE-BID CONFERENCE: A Pre-Bid Conference will be held on July 27, 2017 from 10:00 to 12:00 and August 7, 2017 from 10:00 to 12:00 at a location to be determined by MSU.

ARTICLE 4 – HISTORICALLY UNDERUTILIZED BUSINESS (HUB) SUBCONTRACTING PLAN

4.1 GENERAL DESCRIPTION: Specific attention is called to Article 4 for HUB Plan.

ARTICLE 5 – BONDS AND INSURANCE

5.2.2.1.6 “UMBRELLA” LIABILITY INSURANCE - The amount of Umbrella Liability Insurance shall not be less than $2,000,000.00.

END OF SUPPLEMENTARY GENERAL CONDITIONS


AIA HPA
ARCHITECTS PROGRAMMERS PLANNERS

General Decision Number: TX170326 04/14/2017 TX326

Superseded General Decision Number: TX20160326

State: Texas

Construction Type: Building

County: Wichita County in Texas.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.20 for calendar year 2017 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.20 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2017. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

| Modification Number | Publication Date |
|---|---|
| 0 | 01/06/2017 |
| 1 | 04/14/2017 |

* BOIL0074-003 01/01/2017

| | Rates | Fringes |
|---|---|---|
| BOILERMAKER | $ 28.00 | 22.35 |

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ELEC0681-002 07/01/2016

| | Rates | Fringes |
|---|---|---|
| ELECTRICIAN | | |
| Excluding Low Voltage Wiring | $ 23.74 | 3.5%+8.60 |
| Low Voltage Wiring Only | $ 23.74 | 3.5%+8.60 |

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ENGI0178-005 06/01/2014

| | Rates | Fringes |
|---|---|---|
| POWER EQUIPMENT OPERATOR | | |
| (1) Tower Crane | $ 29.00 | 10.60 |
| (2) Cranes with Pile Driving or Caisson Attachment and Hydraulic Crane 60 tons and above | $ 28.75 | 10.60 |
| (3) Hydraulic cranes 59 | | |

| | | |
|---|---|---|
| Tons and under | $ 27.50 | 10.60 |

IRON0084-011 06/01/2015

| | Rates | Fringes |
|---|---|---|
| IRONWORKER, ORNAMENTAL | $ 23.02 | 6.35 |

PLUM0404-001 07/01/2016

| | Rates | Fringes |
|---|---|---|
| PLUMBER | $ 25.91 | 9.40 |

SUTX2014-052 07/21/2014

| | Rates | Fringes |
|---|---|---|
| BRICKLAYER | $ 20.04 | 0.00 |
| CARPENTER (Acoustical Ceiling Installation Only) | $ 14.00 | 0.00 |
| CARPENTER, Excludes Acoustical Ceiling Installation, and Form Work | $ 13.02 | 0.56 |
| CEMENT MASON/CONCRETE FINISHER | $ 15.32 | 0.00 |
| FORM WORKER | $ 13.99 | 0.23 |
| INSULATOR - MECHANICAL (Duct, Pipe & Mechanical System Insulation) | $ 19.77 | 7.13 |
| IRONWORKER, REINFORCING | $ 12.27 | 0.00 |
| IRONWORKER, STRUCTURAL | $ 22.16 | 5.26 |
| LABORER: Common or General | $ 10.05 | 0.00 |
| LABORER: Mason Tender - Brick | $ 11.36 | 0.00 |
| LABORER: Mason Tender - Cement/Concrete | $ 10.58 | 0.00 |
| LABORER: Pipelayer | $ 12.49 | 2.13 |
| LABORER: Roof Tearoff | $ 11.28 | 0.00 |
| OPERATOR: Backhoe/Excavator/Trackhoe | $ 14.25 | 0.00 |
| OPERATOR: Bobcat/Skid Steer/Skid Loader | $ 13.93 | 0.00 |
| OPERATOR: Bulldozer | $ 18.29 | 1.31 |

| | | |
|---|---|---|
| OPERATOR: Drill | $ 16.22 | 0.34 |
| OPERATOR: Forklift | $ 14.83 | 0.00 |
| OPERATOR: Grader/Blade | $ 13.37 | 0.00 |
| OPERATOR: Loader | $ 13.55 | 0.94 |
| OPERATOR: Mechanic | $ 17.52 | 3.33 |
| OPERATOR: Paver (Asphalt, Aggregate, and Concrete) | $ 16.03 | 0.00 |
| OPERATOR: Roller | $ 12.70 | 0.00 |
| PAINTER (Brush, Roller, and Spray) | $ 14.45 | 0.00 |
| PIPEFITTER | $ 25.80 | 8.55 |
| ROOFER | $ 13.75 | 0.00 |
| SHEET METAL WORKER (HVAC Duct Installation Only) | $ 22.73 | 7.52 |
| SHEET METAL WORKER, Excludes HVAC Duct Installation | $ 21.13 | 6.53 |
| TILE FINISHER | $ 11.22 | 0.00 |
| TILE SETTER | $ 14.74 | 0.00 |
| TRUCK DRIVER: Dump Truck | $ 12.39 | 1.18 |
| TRUCK DRIVER: Flatbed Truck | $ 19.65 | 8.57 |
| TRUCK DRIVER: Semi-Trailer Truck | $ 12.50 | 0.00 |
| TRUCK DRIVER: Water Truck | $ 12.00 | 4.11 |

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including

preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

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The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average

calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

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WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor

200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

# SECTION 011000 - SUMMARY

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Project Information.
   2. Work covered by the Contract Documents.
   3. Owner-furnished products.
   4. Access to Site.
   5. Coordination with occupants.
   6. Work restrictions.
   7. Specification and drawing conventions.

B. Related Sections include the following:
   1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

### 1.3 PROJECT INFORMATION

A. Project Identification: TAS/ADA Fire Marshal Deferred Maintenance to Bolin Science Hall, Ferguson, Fain Fine Arts, and Hardin at Midwestern State University, Existing Facilities.
   1. Project Location: Midwestern State University, 3410 Taft Blvd, Wichita Falls, Texas.

B. Owner: Midwestern State University.
   1. Owner's Representative: Kyle Owen

C. Architect: Harper Perkins Architects, Inc., 4724 Old Jacksboro Highway, Wichita Falls, Texas 76302. Architect’s representatives: Glenda G. Ramsey (Project Architect) or Sam K. Kenshalo (Project Manager); Phone: (940) 767-1421

D. Contractor: Midwestern State University has selected M & F Litteken as the Construction Manger at Risk. The project Manager for M & F Litteken will be Kevin Darnell. M & F Litteken can be reached at 1803 East Scott, Street, Wichita Falls, Texas, 76301, and by telephone at 940-766-4442.

## 1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
   1. The Scope of Work includes four buildings on MSU campus; Bolin Science, Ferguson, Fain Fine Arts and Hardin Administration buildings. Each of these buildings will be renovated or modified to address the Fire Marshal non-compliant findings, deferred maintenance or TAS/ADA code issues. The schedule of construction will greatly be affected by the school schedule. Students are on campus year around and will be utilizing all of the areas under construction. Significant coordination will be necessary to insure project completion.
   2. M & F Litteken, the CMaR for this project will maintain a project schedule that must be complied with.
   3. The following describes the main goals of each location.
   4. Bolin Science Building: Addition of stair towers, egress, ramps, entrance, deferred maintenance to HVAC systems. Stair enclosure, limited flooring, walls and ceilings, exterior sidewalks and handrails. Electrical modifications will be made as necessary to provide and replace the existing transformer. Reference MEP
   5. Ferguson Building: Toilet room renovations, modification to existing stair tower, minor interior walls, ceiling and floor renovations.
   6. Fain Fine Arts: Significant ADA modification, toilet room renovations, stair tower, elevator addition, platform lift, atrium, window replacement, and grade modifications to allow ofr accessibility to restrooms and adjacent spaces.
   7. Hardin Administration: Modification to exterior egress areas, access in Akin Auditorium, and other locations, and Auditorium Toilet renovations.

B. Type of Contract:
   1. The project will be accomplished under a Construction Manager at Risk.

## 1.5 OWNER-FURNISHED PRODUCTS

A. Owner will furnish certain products for the work.
   1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
   2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
   3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
   4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
   5. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
   6. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
   7. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.

8. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
9. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
10. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

B. Owner-Furnished Products: All Owner furnished products are to be furnished and installed.
1. Furniture.
2. Audio and video equipment and systems.
3. Security and Information Technology.
4. Steel Casework.

## 1.6 ACCESS TO SITE

A. General: Contractor shall have limited use of the premises and Project Site for construction operations during construction period as indicated on the Drawings, by the Contract limits, and as indicated by requirements of this Section.

B. Use of Site: Limit use of premises to areas within the Contract limits established by the Owner, Architect and CMaR. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Limits: The site limits shall be determined in pre-work conference with Owner, Architect and CMaR prior to the commencement of work. Do not extend beyond the established parameters.
2. Driveways 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 storage of materials.
    a. Schedule deliveries to minimize use of driveways and entrances.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of the 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. Erect dust proof/security temporary partitions to protect the existing building during construction.

## 1.7 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and existing building during entire construction period. Coordinate and cooperate with the 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 (limited during this summer work period). Maintain the 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 and coordination with the Owner and approval of authorities having jurisdiction.

2. Notify Owner not less than 72 (seventy-two) hours in advance of activities that will affect Owner's operations.
3. The building is a secure facility and access shall be through the designated checkpoint.
4. Utility extensions to the addition will require access to portions of the existing building. Coordination with MSU through the Owner's Designated Representative (ODR) is mandatory. Access through the existing building areas may require work to be done at night and/or weekends.

B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

## 1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless specific arrangements have been made with School Officials.
1. Weekend Hours: as approved.
2. Early Morning or Late Evening Hours: as approved.
3. Hours for Utility Shutdowns: as approved with advance notice.

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 providing temporary utility services according to requirements indicated:
1. Notify Architect and Owner not less than two (2) days in advance of proposed utility interruptions.
2. Obtain Architect's and Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Architect and Owner not less than two (2) days in advance of proposed disruptive operations.
   2. Obtain Architect's and Owner's written permission before proceeding with disruptive operations.

E. Nonsmoking Campus: Smoking is not permitted inside or outside of the buildings or any of the university campus site.

F. Controlled Substances: Use of tobacco products of any kind, illegal drugs, alcohol, and other controlled substances are prohibited on university property.

G. Employee Identification: Provide picture identification tags for all Contractor and Sub-Contractor personnel working on Project site. Require personnel to use identification tags at all times. The tag shall identify the employee and the company by whom the person is employed. Any employee not wearing an identification badge, shall be removed from the site.

H. Employee Screening: Provide background checks for all employees. Comply with Owner's requirements for background screening of Contractor personnel working on Project site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.9 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 may be used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, can be implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations as included as part of this specification.
   3. Products or systems may be specified by brand name and number for quality standards.
   4. Specific brand names and products with no substitutions.

PART 2 - REQUEST FOR PROPOSALS:

2.1 BID PACKAGES: The following “Bid Packages” have been prepared by M & F Litteken. Submit your Proposal by indentifying the Bid Package you are submitting for.

A. The Construction Manager has the right to present a Proposal.
1. Each subcontractor and material supplier is hereby advised that M & F Litteken Construction will be providing competitive sealed Proposals for some of the various Proposal packages. M & F Litteken Construction will be providing sealed Proposals at the same time and place for public opening and evaluation. The Architects and Owners will be present, as well as any interested party, to publicly open the Proposals.
2. MSU is striving to present an open and competitive Proposal format.
3. The Proposal for each package that presents the best value for the project will be awarded a subcontract or purchase order by M & F Litteken Construction, who will perform as a General Contractor during the construction.
4. M & F Litteken Construction has the option to require performance and payment bonds of any subcontractor he deems appropriate.
5. In addition to any items included on the Proposal Form, M & F Litteken Construction will provide an Itemized Proposal Package to the Owner at the time of the opening of the Proposals for the following items: Temporary – Construction Fencing; Project Sign; Job Shack; Porta-Toilets; Daily Cleaning; Final Cleaning; Trash Containment & Disposal; Land Fill Fees; De-watering; Labor & Material for Blocking; Material Only for Thru Wall Flashing; Miscellaneous (not Mechanical – Electrical related); Labor and Material for Backer Rod; Control and Expansion joints.

B. The Proposal Packages are as follows:

1. Earthwork
   a. The work shall include site clearing, site demolition, under floor excavation, and engineered fill. Drainage fill provided within 4” of final sub grade elevation at the location as directed and at the time scheduled by the Project Superintendent.
   b. The work shall be as indicated on the Drawings and in Section 311000 and Section 312000 of the Project Manual.
   c. The Proposal shall include removal of all waste material not used at other locations on site.
   d. The Proposal shall include all surveying work to establish cut and fill and finish grades, as well as locations of building and site elements.
   e. Top Soil shall be provided and placed as a part of this section.
   f. The Contractor shall provide engineered fill as indicated on drawings. Engineered fill shall meet requirements in the plans and specifications.

2. Landscaping
   a. This work shall consist of planting the Trees as shown on the Plans and modifying the existing Lawn Sprinkler System

3. Erosion Control
   a. This shall consist of installing all silt fences and erosion control methods as shown on the drawings

4. Termite Treatment
   a. The work shall include pre-treatment of building slab for termites.
   b. The work shall be as indicated in Section 313116 – Termite Control.

5. Concrete
   a. The work shall include labor and materials to provide all Concrete work excluding Concrete for masonry fill or grouting
   b. The work shall be as indicated on the Drawings and in Section 023720 and Division 3 of the Project Manual.
   c. The Proposal shall include fine grading of drainage fill, vapor barrier, providing, placing and finishing of concrete, form work, setting all inserts and embeds provided by others, and labor to install reinforcing steel.
   d. The final 4” of drainage fill by concrete contractor.
   e. Installation of reinforcing steel in slab and flat work.
   f. This shall be the provision of drilled piers, Section 023720, including drilling, reinforcing steel, tying and placement as well as concrete and concrete placement. Also, this shall include the removal of spoils associated with pier drilling.
6. Masonry
   a. The work shall include all Masonry; including Concrete Masonry units, Brick Masonry and precast stone. The work shall include all materials, labor, and all Masonry work as indicated on the Drawings, and in Division 4 of the Project Manual.
   b. The Proposal shall include providing concrete fill for Masonry, grout, mortar, mortar color, all joint reinforcing insulation and accessories, flashings, damp-proofing if any, shoring and templates or false work, lintels and labor for placing all reinforcing steel associated with Masonry.
   c. The work shall include labor to install and set all masonry imbedded items. The Masonry Contractor shall furnish and install fastening systems, anchors, and provide welding of any anchors where required.
   d. The work shall include water repellants, Section 079100 of exterior face brick as specified (including existing wall where indicated).
   e. Installation of reinforcing steel in masonry walls.
   f. Shall include all Masonry Demolition and patching of existing masonry as required

7. Structural Steel (Materials Only)
   a. The work shall include all structural steel trusses, joists, steel deck, miscellaneous steel and metal fabrications, pipe and tube railings, and architectural joint systems (expansion joint covers) and shall include installation of all elements.
   b. The work shall include labor on site handling at time of delivery.
   c. The work shall be as indicated on the Drawings and in Division 5 of the Project Manual, except Section 054000.
   d. The work associated with the structural steel shall be completed in the phases as laid out by CM@R.

e. The handrails, roof access ladder and other work shall be provided as scheduled.

8. Reinforcing Steel (Materials Only)
   a. The work shall include all reinforcing steel for concrete, masonry and any miscellaneous reinforcing steel as indicated on the Drawings and in the Project Manual, Section 032000.
   b. The work shall include labor on site handling at time of delivery.
   c. Provide all reinforcing steel for concrete and masonry.

9. Steel Erection
   a. This shall include all labor and equipment required to erect the Structural Steel provided in Bid Item 7.

10. General Select Demolition – Section 022300
   a. This Section is to include Site Clearing and selected Demolition.
   b. Demolition of Interior Walls & Ceilings as indicated on Drawings
   c. Demolition of Flooring as indicated on Drawings
   d. Demolition of Doors & Frames as Indicated on Drawings
   e. Demolition of Cabinets as indicated on Drawings.
   f. Mechanical Demolition to be included in HVAC Package
   g. Plumbing Demolition to be included in Plumbing Package
   h. Electrical Demolition to be included in Electrical Package

11. Rough Carpentry, and Miscellaneous Installations
   a. The work shall provide materials and labor for all wood nailers, including nailers that are a part of the roofing system, equipment bases, and blocking, for attachment of other work. The blocking for the attachment of cabinetwork shall be by others. The work shall include all caulking and sealants, except those performed by window installation and painting.
   b. The work shall be as indicated on the Drawings and in the Project Manual, including Section 061000 – Rough Carpentry.
   c. The work shall include Section 079200 – Joint Sealants.
   d. Installation of all Division 10 items not otherwise indicated for materials and installation; doors, frames and hardware not otherwise indicated for materials and installation, toilet partitions, accessories, fire extinguishers and signs.
   e. Installation of all Doors and Hardware
   f. Include Galvanized Metal Covered Base in this Item.
   g. This shall include the removal of the existing wood framing, plywood, etc., associated with the single-slope clay tile roof as shown on the plans.
   h. This shall include installation of the Fluid Applied Membrane Air Barrier, Section 072726.
12. Cabinets
   a. The work shall include wood trim and hand railings as indicated on the Drawings.
   b. The work shall include the provision of Solid Surface Window Sills as indicated on the Drawing and in the Project Manual, Section 064040.

13. Roofing & Sheet metal
    a. This shall include all work covered by Sections 073213- Clay Roof Tiles, 075423- Thermoplastic Membrane Roofing, 076200, Sheet Metal Flashing and Trim; 077200, Roof Accessories.
    b. This shall also include the removal and storage on site of the existing Clay Tile Roofing as shown on plans and the installation of these tiles in new locations.

14. Hollow Metal Doors, Frames, Hardware (Materials Only)
    a. The work shall include providing all Doors, Frames and Hardware.
    b. The work shall include providing materials for all work indicated on the Drawings and in the Project Manual, including Section 081113 – Steel Doors and Frames; Section 081416 – Flush Wood Doors; Section 087100 – Door Hardware.
    c. The materials shall be provided as appropriate with the stage of construction and as scheduled by M & F Litteken Construction.
    d. Any individual item may be bid separately. Include breakdown for each section.

15. Glass and Glazing
    a. The work shall include all Labor and Material to install all glass and glazing of windows, doors, vision panels, borrowed lites, unframed mirrors, reverse mirrored glass, and other glazing as indicated on the Drawings and in the Project Manual, Section 088000 - Glazing, 084113 - Aluminum Framed Entrances and Storefronts; Section 084413 – Glazed Aluminum Curtain Wall.
    b. The Proposal shall include caulking and sealants associated with this work.
    c. This Proposal shall also include the demolition of existing Glass and Storefront as shown on plans

16. Drywall and Acoustical Ceiling
    a. The work shall include all Interior and Exterior Metal Framing and Drywall sheathing, including Acoustical Ceiling and associated Insulation.
    b. The work shall be as indicated on the Drawings and in the Project Manual, including Section 054000 – Cold Formed Metal Framing; 061600 – Sheathing; Section 092550 – Gypsum Board Assemblies; Section 095113 – Acoustical Panel Ceilings; and appropriate portions of Section 072100 – Building Insulation.
    c. Tape and bedding shall be part of the painting.

17. Floor Covering
    a. The work shall include all Floor Covering work as indicated on the Drawings and in the Project Manual, Section 096813 – Tile Carpeting; Section 096513 – Resilient Wall Base and Accessories; Section 096500 – Resilient Tile Flooring; Section 096600 – Terrazzo Tile.
    b. The Proposal shall include floor covering and base, including vinyl composition tile, rubber base, carpet, and other floor covering indicated.

18. Ceramic Tile – Materials and Labor
    a. The work shall include Ceramic Floor and Wall Tile, associated trim, corners and caps; floor prep and leveling, floor latex bond coat, and crack suppression membrane, if required.
    b. The work shall be as indicated on the drawings and in the Project Manual including Section 093100 – Ceramic Tile, 099990 – Finish Schedule, and 099999 – Finish Schedule Key.

19. Terrazzo – Materials and Labor
    a. The work shall include all materials and labor to patch, replace and repair Terrazzo in locations where walls, doors and openings have destroyed existing Terrazzo.
    b. The patched areas are to match the existing in color, size of aggregate and resin color at each location.
    c. The work shall include selective demolition as indicated on the drawings and Project Manual including Section 096623.

20. Painting
    a. The work shall provide all Painting both, exterior and interior where specified in finish schedule and drawings.
    b. The work shall be as indicated on the Drawings and in the Project Manual, including Section 099100 – Painting, and Section 099900 – Finish Schedule.
    c. The work shall include the taping, bedding, and texturing (where specified) of all drywall.
    d. The work shall include painting or staining and finishing cabinetry and interior wood detail and trim.

21. Division 10 (Materials Only) – Fire Extinguisher Cabinets, Sign, Toilet Compartments & Accessories;
    a. The work shall include providing all Division 10 Items and miscellaneous items indicated on plans.
    b. The work shall include providing materials for all work indicated on the Drawings and in the Project Manual, including Section – 101550 – Toilet Compartments; Section – 102600 – Aluminum Corner Guards; 108010 Toilet & Bath Accessories; Section 104413 – Fire Protection Specialties; Section 104250 - Sign.
    c. The materials shall be provided as appropriate with the stage of construction and as scheduled by M & F Litteken Construction.
    d. Any individual item may be bid separately. Include breakdown for each section.

22. Window Treatment-
    a. Shall include the furnishing and installation of items in Section 125110 – Horizontal Louver Blinds.

23. Elevator
    a. The work shall include all materials and labor to furnish and install Elevator.
    b. The work shall include coordination with MEP and Structural Contractors for complete assembly and final connections as necessary.

c. The work shall include coordination with trades as necessary for color and finish selections.
d. The work shall include all fire caulking of all penetrations and grout, leveling and caulking.
e. All work necessary for a complete functioning Elevator.

24. Platform Lift
    a. The work shall include all materials and labor to furnish and install Platform Lift.
    b. The work shall include coordination with MEP and Structural Contractors for complete assembly and final connections as necessary.
    c. The work shall include coordination with trades as necessary for color and finish selections.
    d. The work shall include all fire caulking of all penetrations and grout, leveling and caulking.
    e. All work necessary for a complete functioning Platform Lift.

25. Plumbing
    a. The work shall include all Plumbing work as indicated on the Drawings and in Division 22 of the Project Manual.
    b. The Proposal shall include all Plumbing work including plumbing site work (including all patchwork necessary to return to existing condition).
    c. The Proposal shall include providing the fire caulking of all penetrations through fire-rated partitions or floor assemblies.
    d. The work shall include color-coding and identification of piping and valves on Mechanical Systems and Equipment.
    e. The work shall include labor and materials for the installation of condensate drain piping as indicated on the Mechanical Drawings.
    f. All utility extensions and connections to main locations shall be included
    g. Provide Sinks and coordination of installation with Cabinet Sub-contractor.

26. Fire Suppression System
    a. Shall include all labor and material to complete Fire suppression System for the addition as shown in the Drawings.

27. Mechanical
    a. The work shall include all Heating, Ventilation, and Air Conditioning work as indicated on the Drawings and in Division 23 of the Project Manual.
    b. The Proposal shall include all HVAC Controls, including conduit and conductor, as well as providing installation and connection of control devices.
    c. The Proposal shall include providing the fire caulking of all penetrations through fire-rated partitions or floor assemblies.

28. Electrical, Fire Alarm
    a. The work shall include all Electrical and Fire Alarm work and as indicated on the Drawings and in Project Manual, Divisions 26 and 28.
    b. The Proposal shall include providing fire caulking for all penetrations of fire-rated partitions and floor assemblies.

c. The Proposal shall include the cost for installation of temporary electrical service, power and lighting, as well as the removal of all temporary electrical as the project completes. It is the intent for the power to be drawn from existing devices or temporarily connected to existing panels.
d. The actual cost of consumption of the electrical power will be provided by the Owner.
e. The work shall include all Fire Alarm work as indicated on the Drawings and in the Project Manual, Division 28, Electrical.
f. This proposal to include all computer and data conduit and boxes as shown on the drawing and as specified.

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

# SECTION 012100 - ALLOWANCES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Contingency allowances.

C. Related Requirements:

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

### 1.3 SELECTION AND PURCHASE

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

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

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

### 1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

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

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 CONTINGENCY ALLOWANCES

A. Provide a five percent (5%) contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

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

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

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

1.8 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Contingency Allowance: Include a contingency allowance of five percent (5%) for use according to Owner's written instructions.

END OF SECTION 012100


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# SECTION 012300 - ALTERNATES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

1. 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

1. Section includes administrative and procedural requirements for alternates.

### 1.3 DEFINITIONS

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

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

### 1.4 PROCEDURES

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

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

2. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

3. Execute accepted alternates under the same conditions as other work of the Contract.

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

## PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

**Proposers Bidding Procedure Note: Each of the Alternates is "stand alone" for each item listed below. Provide a Proposal number that includes a bid for that Alternate item that can be added or deleted from the Base Bid. On your Proposal indicate if the Alternate item is an: Addition or Deletion.**

**SCHEDULE OF ALTERNATES:**

1. ALTERNATE #1: At Bolin Science Hall in the new stair tower, provide painted steel hand railing with associated steel hand railing with associated steel angle frames and mesh in lieu of aluminum hand railing. Refer to the Drawings for more information.

END OF SECTION 012300

# SECTION 012500 - 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.

B. Refer to Uniform the General Conditions, Section 8.3.5 and 8.3.6 for substitutions. The most stringent requirement between UGC and this section shall apply.

### 1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.
   1. All substitution documents shall be done electronically.

B. Related Requirements:

   1. Section 016000 "Product Requirements" and UGC 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.

### 1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit electronic 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. 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 side by side comparison of the qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. The 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, only if specifically required.
i. 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.
j. Cost information, showing the cost reduction or no change to the contract amount.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, is appropriate for applications indicated and the Contractor accepts total responsibility for the performance of the substituted item or system.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) 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.
c. Architect’s approval of substituting does not certify the performance of the material or system.

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

B. Substitutions for Convenience: Architect will consider requests for substitution if received within thirty (30) days after the Notice to Proceed. Requests received after that time will not be considered.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.

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

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

# SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

B. Refer to Uniform General Conditions, Article 11 for Change Order procedures. The most restrictive between the UGC and this section shall apply.

### 1.2 SUMMARY

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

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

2. Refer to UGC Article 11.8 for maximum allowable percentages for changes in the work.

### 1.3 MINOR CHANGES IN THE WORK

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

### 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 twenty (20) days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

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

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

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

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

## 1.5 CHANGE ORDER PROCEDURES

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

## 1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Work Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work where the time or cost cannot be agreed upon. See General Conditions for detailed procedures, for subsequent inclusion in a Change Order.

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600


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# SECTION 012900 - 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.

B. Refer to Uniform General Conditions, Article 10 for payment procedures that may differ from this section. The most restrictive of the two shall prevail.

### 1.2 SUMMARY

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

B. Related Requirements:

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

### 1.3 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 fourteen (14) days before the date scheduled for submittal of initial Applications for Payment.

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

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

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

2. Arrange schedule of values consistent with format of AIA Document G703, 1992 Edition.
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 (5%) percent of the Contract Sum but specifically for plumbing, mechanical and electrical. Provide a line item for each Specification Section.
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. No payment will be made for items stored off-site.

7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the schedule of values for each allowance.
9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

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

10. 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 30th day of the month. The period covered by each Application for Payment is one month, ending on the 25th day of the month.

1. Submit draft copy of Application for Payment seven (7) days prior to due date for review by Architect.

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.
5. Retainage of 5% shall be included for all work and stored materials that are shown on application.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored at the site of construction, but not yet installed. No payment will be made for materials stored off site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit four (4) 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. 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.
4. Schedule of unit prices.
5. Submittal schedule.
6. List of Contractor's staff assignments.
7. List of all Sub Contractors and suppliers.
8. Copies of building permits.
9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
10. Initial progress report.
11. Report of preconstruction conference.
12. Certificates of insurance and insurance policies.
13. Performance and payment bonds.

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

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

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

1. Evidence of completion of Project closeout requirements.
2. 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, 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.
10. Retainage will not be released until all documents have been processed and punch list items have been completed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

# SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

B. Refer to Uniform General Conditions for Pre-Construction Conference and general responsibilities.

### 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 meetings.

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

### 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, using Excel software:

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 (fifteen) days of the Notice to Proceed, 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.

C. Sub-Contractors: Within 15 (fifteen) days of the Notice to Proceed, submit a list of Sub-Contractors with the names of their key personnel assignments. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses.

## 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. 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.

C. 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 (32 mm) 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. 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.

9. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

## 1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: After thorough examination of the Contract Documents it is discovered of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

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

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

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

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.

1. Attachments shall be electronic format to allow Architect to respond on the RFI or attachment.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) working days, after receipt by the Architect, 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 012600 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within ten (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 at each project site meeting and with each Certificate of Payment. Software log in Excel with not less than the following:

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

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction 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: The CMaR is responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within five (5) days of the meeting. The minutes shall be comprehensive including looking forward to two week approaching milestones. The notes shall also include job tasks assigned if information is needed and deadline for information responsibility.

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

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

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. 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. Preparation of record documents.
    m. Use of the premises and existing building.
    n. Work restrictions.
    o. Working hours.
    p. Owner's occupancy requirements.
    q. Responsibility for temporary facilities and controls.
    r. Procedures for moisture and mold control.
    s. Procedures for disruptions and shutdowns.
    t. Construction waste management and recycling.
    u. Parking availability.
    v. Office, work, and storage areas.
    w. Equipment deliveries and priorities.
    x. First aid.
    y. Security.
    z. Progress cleaning.
3. Minutes: The CMaR is responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within five (5) days of the meeting. The minutes shall be comprehensive including looking forward to two week approaching milestones. The notes shall also include job tasks assigned if information is needed and deadline for information responsibility.

C. Coordination Meetings: Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

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

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

    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined 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.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor 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) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Change Orders.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100


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# SECTION 013200 - 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.

B. Refer to the Uniform General Conditions, Article 9, for UGC schedule requirements. The most restrictive between the UGC and this section shall prevail.

### 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. Contractor's construction schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Material location reports.
5. Site condition reports.
6. Special reports.
7. Rain Delay Days.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
2. Section 014000 "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.

H. Rain Days:

1. According to U.S. Climate Data, the following days will be allowed as typical weather days. They must be used before additional days are approved.
   a. January 1, February 2, March 2, April 2, May 4, June 3, July 1, August 2, September 3, October 3, November 2 and December 2.

1.4 INFORMATIONAL SUBMITTALS

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

1. PDF electronic file.
2. Two (2) paper copies.

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

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

C. 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.

D. Construction Schedule Updating Reports: Submit with each Application for Payment. Payment Applications will NOT be processed without schedule update.

E. Daily Construction Reports: Submit at monthly intervals with each Application for Payment.

F. Material Location Reports: Submit at monthly intervals with each Application of Payment.

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

H. 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 013100 "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.

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

1. Activity Duration: Define activities so no activity is longer than twenty (20) days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than sixty (60) days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than fifteen (15) days for startup and testing.
5. Substantial Completion: Indicate completion.
6. Punch List and Final Completion: Include not more than thirty (30) days for completion of punch list items and final completion.

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

1. Work by Owner: Include a separate activity for each portion of the Work performed by Owner, if any.
2. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Work Restrictions: Show the effect of the following items on the schedule:

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

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

6. 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.

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

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

1. Use Microsoft Project, for operating system.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than sixty (60) days after date established for the Notice to Proceed.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Mobilization and demobilization.
c. Purchase of materials.
d. Delivery.
e. Fabrication.
f. Utility interruptions.
g. Installation.

h. Work by Owner that may affect or be affected by Contractor's activities.
i. Testing.
j. Punch list and final completion.
k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

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

## 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 (1) 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

## 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Scheduling Consultant: At the Contractor’s option, engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant or in-house scheduler shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule before each regularly scheduled progress meeting with Certificate of Payment. Certificates of Payment will NOT be processed without an updated construction schedule.

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

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

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

END OF SECTION 013200

# SECTION 013300 - 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.

B. Refer to the Uniform General Conditions, Article 8, for Submittal Procedures. Where UGC and this section differ, the most restrictive shall prevail.

### 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 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

### 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. Final Submittal Schedule: 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.

3. Format: Arrange the following information in a tabular format:

a. Scheduled date for first submittal.
b. Specification Section number and title.
c. Submittal category: Action; informational.
d. Name of subcontractor.
e. Description of the Work covered.
f. Scheduled date for Architect's final release or approval.
g. Scheduled date of fabrication.
h. Scheduled dates for purchasing.
i. Scheduled dates for installation.
j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor limited digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
b. Digital Drawing Software Program: The Contract Drawings are available in Auto CAD DWG or PDF format.
c. The following digital data files will by furnished for each appropriate discipline:

1) Floor plans.
2) Reflected ceiling plans.
3) Mechanical and Electrical electronic files will not be made available.
4) Structural drawings will only be made available on a selected basis and with permission of the structural engineer.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of 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 14 total 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 14 total 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 14 total 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 14 total 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. All submittals are to be in Digital Format.
2. 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.
3. Name file with submittal number or other unique identifier, including revision identifier.
4. Transmittal Form for Electronic Submittals: Use form acceptable to Architect**,** containing the following information:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Contractor.
    e. Name of firm or entity that prepared submittal.
    f. Names of subcontractor, manufacturer, and supplier.
    g. Category and type of submittal.
    h. Submittal purpose and description.
    i. Specification Section number and title.
    j. Specification paragraph number or drawing designation and generic name for each of multiple items.
    k. Drawing number and detail references, as appropriate.

l. Location(s) where product is to be installed, as appropriate.
m. Related physical samples submitted directly.
n. Indication of full or partial submittal.
o. Transmittal number, numbered consecutively.
p. Submittal and transmittal distribution record.
q. Other necessary identification.
r. Remarks.

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. For files larger than 2 megabytes post electronic submittals as PDF electronic files directly to Architect’s email address or to “Transfer Big Files” or “Drop Box”.

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

2. For files 2 megabytes or smaller submit electronic submittals via email as PDF electronic files.

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

3. Action Submittals: Submit digital copies of each submittal unless otherwise indicated. Architect will return electronically.

4. Informational Submittals: Submit digital copies of each submittal unless otherwise indicated. Architect will return electronically.
5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

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

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

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

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

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

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

    a. PDF electronic file.

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

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

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

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 inches by 36 inches.
3. Submit Shop Drawings in one of 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. Samples for Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one (1) full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will indicate the option selected in color schedule.

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

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

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

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

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

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

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

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

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

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

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

P. 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.

Q. 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.

R. 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.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

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

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

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

D. Should it become evident that the Contractor has not performed a thorough review, but rubber stamped and sent forward, the Architect shall return unchecked for the Contractor to provide a thorough review.

### 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 stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

- Approved – The work covered by the submittal may proceed provided it complies with the contract documents. Final acceptance will depend on that compliance.

- Approved As Noted – The work covered by the submittal may proceed provided it complies with both Architect's notations and corrections on the submittal and the contract documents. Final acceptance will depend on that compliance.

- Not Approved – Revise and Resubmit – DO NOT proceed with the work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to the Architect's notations and corrections.

- Rejected – DO NOT proceed with the work covered by the submittal. Prepare a new submittal for a product that complies with the contract documents.

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

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

END OF SECTION 013300

# SECTION 014000 - 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.

B. Refer to the Uniform General Conditions with emphasis on Article 8. Should UGC and these specifications differ, the most restrictive shall apply.

### 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, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

C. Related Requirements:

### 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.

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 (5) 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 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

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

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

D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 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.

## 1.7 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 Texas, 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 products that are similar in material, design, and extent to those indicated for this Project.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, 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.

G. 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.

H. 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.

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

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. 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, mockups; do not reuse products on Project.
g. Contractor shall pay for all tests to show compliance with Contract Documents.

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

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

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven (7) 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 and Owner’s approval of mockups before starting work, fabrication, or construction.

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.

1.8 QUALITY CONTROL

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

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
3. In general the Owner will pay for On-Site testing. Tests required to prove materials are acceptable for the project and responsibility of the Contractor.

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

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

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

3. Notify testing agencies at least twenty-four (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.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

D. 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.

E. 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.

F. 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.

G. 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.

H. 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.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 REPAIR AND PROTECTION

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

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible

as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

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

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

END OF SECTION 014000

# SECTION 014200 - REFERENCES

## PART 1 - GENERAL

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

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

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

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

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

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

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

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

### 1.3 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.

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 Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

# SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

B. Refer to the Uniform General Conditions for Additional Requirements, specifically refer to Article 8. Where UGC and these specifications differ the most stringent shall prevail.

### 1.2 SUMMARY

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

B. Related Requirements:

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

### 1.3 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, testing agencies, and authorities having jurisdiction.

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

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

### 1.4 INFORMATIONAL SUBMITTALS

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

B. 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.

3. Indicate sequencing of work that requires water, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

C. 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. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. 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. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

B. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).

C. 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 FACILITIES

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

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.

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.

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. 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.

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.

B. 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.

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

D. 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.

E. Telephone Service: Provide temporary telephone service in Field Office for use by all construction personnel.

1. Provide additional telephone lines for the following:

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

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

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

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

F. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.

## 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 (9 m) 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. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

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

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

D. Lifts and Hoists: Provide facilities necessary for hoisting materials.

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

E. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

1. Do not load elevators beyond their rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

F. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

## 3.4 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 011000 "Summary."

C. 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 two layers of 6-mil (0.14-mm) polyethylene sheet on each side. Cover floor with two layers of 6-mil (0.14-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.

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

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

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

## 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. 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. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

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

## 3.6 OPERATION, TERMINATION, AND REMOVAL

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

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

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

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

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

E. 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.

END OF SECTION 015000


AIA HPA
ARCHITECTS PROGRAMMERS PLANNERS

# SECTION 016000 - 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.

B. Refer to the total Uniform General Conditions, specifically Article 8 for requirements. Where UGC and these specifications differ, the more stringent shall apply.

### 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 012500 "Substitution Procedures" for requests for substitutions.
2. Section 014200 "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.

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 of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

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

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

1.5 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 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.

B. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

# PART 2 - PRODUCTS

## 2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
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 be considered.
    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 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 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

## 2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000


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# SECTION 017300 - 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.

B. Refer to the Uniform General Conditions where requirements differ from these specifications, the more restrictive shall apply.

### 1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Installation of the Work.
2. Cutting and patching.
3. Progress cleaning.
4. Starting and adjusting.
5. Protection of installed construction.
6. Correction of the Work.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting surveys.
2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

### 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 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural 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.

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.
    b. Membranes and flashings.
    c. Exterior curtain-wall construction.
    d. Sprayed fire-resistive material.
    e. Equipment supports.
    f. Piping, ductwork, vessels, and equipment.
    g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. 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. 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.

B. 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.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. 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.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

## 3.4 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. 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.
5. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    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.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

## 3.5 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    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 015000 "Temporary Facilities and Controls." Section 017419 "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.

## 3.6 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

## 3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300


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# SECTION 017700 - 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.

B. Refer to the total Uniform General Conditions, but specifically Article 12. Where the UGC and these specifications vary, the most restrictive shall apply.

### 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 017300 "Execution" for progress cleaning of Project site.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

### 1.3 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 ten (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.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.

10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (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 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. 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.
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. MS Excel or MS Word 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 fifteen(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, **RED** in color, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: 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**[, elevator 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. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

# SECTION 017823 - OPERATION AND MAINTENANCE DATA

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

B. Refer to the Uniform General Conditions for Project Completion and Warranty and Guarantee requirements.

### 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. Operation manuals for systems, subsystems, and equipment.
3. Product maintenance manuals.
4. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

### 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. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

    a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    b. Enable inserted reviewer comments on draft submittals.

2. Three (3) paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two (2) copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least thirty (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 fifteen (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 fifteen (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 Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

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, **RED** in color, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-

280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. 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. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

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

## 2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor 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.

2.4 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual 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.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual 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.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

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.
2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823


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# SECTION 017839 - 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.

B. Refer to the Uniform General Conditions in total with emphasis on Article 6. This specification shall take precedence over UGC.

### 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. Related Requirements:
1. Section 017300 "Execution" for final property survey.
2. Section 017700 "Closeout Procedures" for general closeout procedures.
3. Section 017823 "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 one (1) set(s) of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit one (1) paper-copy set(s) of marked-up record prints.
2) Submit PDF electronic files of scanned record prints and one (1) of file prints.
3) Submit record digital data files and one (1) set(s) of plots.
4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit three (3) paper-copy set(s) of marked-up record prints.
2) Submit PDF electronic files of scanned record prints and three (3) set(s) of prints.

3) Print each drawing, whether or not changes and additional information were recorded.

c. Final Submittal:

1) Submit three (3) paper-copy set(s) of marked-up record prints.
2) Submit record digital data files and three (3) set(s) of record digital data file plots.
3) Plot each drawing file, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one (1) paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one (1) paper copy and 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 three (3) paper copies and 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.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations 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 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. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, in record Specifications, and on record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

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 reference during normal working hours.

END OF SECTION 017839


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# SECTION 017900 - 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.

B. The Uniform General Conditions are a part of the Contract Document. Where they differ from these specifications, the more restrictive shall prevail.

### 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, on equipment as requested by Owner.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

### 1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

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

C. 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 two (2) copies within seven (7) 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 Construction Manager.

d. Name of Contractor.
e. Date of video recording.

2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page. In addition provide a PDF in electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on compact disc.

## 1.5 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 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

## 1.6 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. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

### 3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect, with at least seven (7) days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

## 3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Provide a recording of the demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 1080P (or 720 min) video resolution converted to format file type acceptable to Owner, on electronic media.

1. Electronic Media: DVD or flash drive acceptable to Owner.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. 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: 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.

E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

G. Preproduced Video Recordings: Video recordings may be used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

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. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to drilling of piers as described herein and/or as shown on the Drawings.

B. Related Documents:
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to Work of this section.

C. Related Sections:
1. Section 032000 – Concrete Reinforcement.
2. Section 033000 – Cast-in-Place Concrete.
3. Geotechnical Investigation Report: Furnished by Owner.

1.3 REFERENCES

A. American Concrete Institute (ACI).
1. ACI 301, Specifications for Structural Concrete for Buildings.
2. ACI 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
3. ACI 305R, Hot Weather Concreting.
4. ACI 306R, Cold Weather Concreting.
5. ACI 311, ACI Manual of Concrete Inspection.
6. ACI 309, Standard Practice for Consolidation of Concrete.
7. ACI 311, ACI Manual of Concrete Inspection.
8. ACI 318, Building Code Requirements for Structural Concrete.
9. ACI 336.1, Standard Specification for the Construction of End Bearing Drilled Piers.

1.4 SUBMITTALS

A. Reinforcement: Refer to Section 032000.

B. Concrete: Refer to Section 033000.

1.4 MEASUREMENT AND PAYMENT

A. The Contract sum shall include all labor, materials, overhead and profit for completing drilled piers including removal of spoil. Cost of providing and placing of casings is to be included in base Contract. If casings are not required, cost of providing, installing, and removing same will be deducted from the Contract based on unit prices specified in other sections. Top of bearing stratum shown on Contract Drawings is for estimating purposes only. Pier drilling log prepared by the Testing Laboratory shall be used to adjust the Contract amount for greater and lesser pier depths, based on the actual top of bearing stratum elevation, or greater depths due to presence of sand

pockets or clay seams encountered during the drilling process. Payment will not be made for pier penetrations into bearing stratum greater than that required by the Contract Documents, unless approved by Owner and Architect.

## PART 2 PRODUCTS

### 2.1 MATERIALS

A. Reinforcement: Refer to Section 032000.

B. Concrete: Refer to Section 033000.

## PART 3 EXECUTION

### 3.1 DRILLING

A. Schedule pier drilling so piers will be filled with concrete immediately after drilling. Fill each pier with concrete within eight (8) hours after completion of drilling of same.

B. Drill piers with power auger foundation drilling equipment designed for that purpose. Locate piers to within one inch (1") maximum tolerance horizontally in any direction. Drill piers to size and depth shown, vertically, with maximum acceptable tolerance from plumb in any shaft, measured in center of shaft, not to exceed one inch (1") in any ten feet (10') with a maximum of two inches (2"). Piers drilled outside of maximum tolerance will be rejected.

C. If caving or substantial amounts of ground water are encountered, use casings to prevent caving and exclude water. Install casing sufficient distance into bearing strata to insure watertight seal.

D. If sand pockets or clay seams are encountered at the bottom of the pier hole, the pier depth must be increased to avoid bearing the pier within the sand or clay layer. The amount of increase in the pier depth shall be determined on an individual basis for each pier, and as recommended by the geotechnical engineer present on site during the drilling operation.

### 3.2 PUMPING AND CLEANING

A. After pier holes have been drilled to proper depth and cutting edge of casing is seated, if required, pump water out.

B. Clean bottom of pier excavations of loose material and foreign matter and receive approval of Testing Laboratory before depositing concrete.

### 3.3 PLACING REINFORCING STEEL AND CONCRETE

A. Do not place steel or concrete until pier holes have been inspected and approved by Testing Laboratory.

B. Maintain minimum three-inch (3") clearance between bottom of excavation and sides of excavation and reinforcement.

C. Pier reinforcing steel shall be properly positioned within the drilled shaft by a positive recognized means, equal to Centraligner® Pier Sleds manufactured by PIERESEARCH, Arlington, Texas.

D. Provide reinforcing steel dowels as detailed or scheduled. Secure reinforcement, including dowels, in place, free of contact with sides of excavations.

E. All concrete shall be placed so as to prevent segregation. Do not allow concrete to free fall over five (5) feet; provide tremie, chutes or other means of conveyance when drop exceeds this amount.

3.4 REMOVAL OF CASING

A. Prior to breaking seal between temporary casing and underlying strata, static head of plastic concrete shall be sufficiently above ground water and caving soils from entering hole during removal of casing. Once seal has been broken, temporary casing may be slowly removed in a vertical direction (no rotation permitted) while additional concrete is placed to top of pier.

3.5 IMPROPER INSTALLATION

A. The Contractor shall pay the cost of any and all changes due to improper installation of drilled piers. This shall include Architect's and Engineer's additional services made necessary by such failure, as well as costs for labor and materials.

3.6 FIELD QUALITY CONTROL AND TESTING

A. Soils Testing Laboratory shall make continuous inspections of pier drilling operations to determine that proper bearing stratum is obtained and utilized for bearing and that shafts are properly clean and dry before placing concrete.

B. Furnish complete pier log, showing pier number, date, weather conditions, ground elevation, the diameter, top and bottom elevations of each pier, casing required or not required, actual penetration into bearing stratum, elevation of top of bearing stratum, concrete truck, ticket number, water added at job site, slump, reinforcement and any and all observed irregularities, deficiencies or deviations from the Contract Documents.

C. Pier drilling shall be scheduled such that the concrete can be placed immediately after inspection.

END OF SECTION 023720


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# SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of 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 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
3. Section 017300 "Execution" for cutting and patching procedures.
4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

### 1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

### 1.4 MATERIALS OWNERSHIP

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

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site at date prior to commencement of demolition operations.

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, including but not limited to, roof and clearstory on existing building.

1.6 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for dust control and, for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's 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.

C. Predemolition Photographs: Submit before Work begins. Carefully and completely document any existing damage to existing structure.

D. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

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: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site 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.
2. Utilities service may not be interrupted during normal MSU hours of operation. Schedule interruptions at night or weekend.

1.9 WARRANTY

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

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Request and review record documents of existing construction available through the Architect. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

## 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. 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 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.
    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.

C. Refrigerant: Where refrigerant is in a system to be demolished, remove refrigerant from mechanical equipment to be demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

## 3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

C. Temporary Shoring: 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.

## 3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. 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[ fire watch and] 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 017419 "Construction Waste Management and Disposal."

B. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area off-site as designated by Owner.
5. 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.

## 3.5 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, then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, 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.

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 Roofing Section for new roofing requirements.

1. Remove portions of existing roof membrane, flashings, copings, and roof accessories.

## 3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

## 3.7 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 024119


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SECTION 030586 – VAPOR BARRIER

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.

1.1 SUMMARY

A. Section Includes:
1. Furnish all labor, materials, services and equipment as required to place vapor barrier, seam tape, and mastic for installation under concrete slabs.

B. Related documents:
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements apply to Work of this section.

C. Related sections:
1. Section 031100 – Concrete Forming.
2. Section 033000 – Cast-in-Place Concrete.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM E 1745-11 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
2. ASTM E 154-99 (2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
3. ASTM E 96-05 Standard Test Methods for Water Vapor Transmission of Materials.
4. ASTM F 1249-06 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
5. ASTM E 1643-11 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. American Concrete Institute (ACI):
1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.3 SUBMITTALS

A. Quality control/assurance:
1. Summary of test results as per paragraph 8.3 of ASTM E 1745.
2. Manufacturer’s samples, literature.
3. Manufacturer’s installation instructions for placement, seaming and penetration repair instructions.

1.4 QUALITY ASSURANCE

A. Conform to the requirements of ACI 302.2R.

B. Installer Qualifications: Company specializing in performing under slab vapor barrier installations experienced in use of specified projects with minimum five (5) years documented experience in under slab vapor barrier installation.

C. Stego Manufacturer Regional Representative: Manufacturer representative shall be on-site the day of vapor barrier placement to instruct contractor in proper vapor barrier system installation, document installation and verify that proper procedures are followed.

C. Manufacturer Installation Instructions: Contractor shall maintain current copy of vapor barrier manufacturer published installation instructions in Project Field Office and refer to installation instructions at all times during installation.

1.5 DELIVERY, STORAGE AND HANDLING

A. Division 1, General Requirements - Product Options: Transport, handle, store, and protect Products.

B. Deliver vapor barrier in rolls in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Deliver Material Safety Data Sheet (MSDS) for each material to Project Field Superintendent for Contractor Records.

D. Accept Products on site in manufacturer's packaging. Inspect for damage. Return damaged Products and replace with undamaged Products.

E. Project Field Superintendent shall inspect Products immediately upon delivery to Project Site, determine Product conformance with specified requirements and reject Products not complying with specifications. Project Field Superintendent shall direct that non-complying Products be removed from Project Site immediately.

F. Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS

A. Where noted on Drawings, 15 mil. Vapor barrier must have all of the following qualities:
   1. Permeance of less than 0.01 Perms [grains/($ft^2$ * hr * inHg)] per ASTM F 1249 or ASTM E 96.
   2. Maintain permeance of less than 0.01 Perms [grains/($ft^2$ *hr * in.Hg)] after mandatory conditioning tests per ASTM E 154 Sections 8,11,12, and 13.
   3. Other performance criteria:
      a. Strength: ASTM E 1745 Class A.
   4. Vapor barrier products:
      a. Stego Wrap 15-mil Vapor Barrier by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Where noted on Drawings, 10 mil. Vapor barrier must have all of the following qualities:

1. Permeance of less than 0.03 Perms [grains/($ft^2$ * hr * inHg)] per ASTM F 1249 or ASTM E 96.
2. Maintain permeance of less than 0.03 Perms [grains/($ft^2$ *hr * in.Hg)] after mandatory conditioning tests per ASTM E 154 Sections 8,11,12, and 13.
3. Other performance criteria:
   a. Strength: ASTM E 1745 Class A.
4. Vapor barrier products:
   a. Stego Wrap 10-mil Vapor Barrier by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

2.2 ACCESSORIES

A. Seam tape:
   1. Permeance less than 0.3 perms or lower per ASTM F 1249 or ASTM E 96.
   2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Vapor-proofing mastic:
   1. Permeance less than 0.3 perms or lower per ASTM F 1249 or ASTM E 96.
   2. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

C. Pipe Boots:
   1. Construct pipe boots from vapor barrier material pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 EXECUTION

3.1 PREPARATION

A. Ensure that base material is approved by Architect or Geotechnical Engineer.
   1. Level and compact base material.

3.2 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E 1643-11.
   1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement.
   2. Lap vapor barrier over footings and/or seal to foundation walls.
   3. Overlap joints 12 inches and seal with manufacturer's tape.
   4. Seal all penetrations (including pipes) per manufacturer's instructions.
   5. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
   6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 12 inches and taping all sides with tape.

3.3 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements – Execution, for additional requirements on a Contractor Quality Control Representative to perform contractor quality control inspections.
   1. Inspect installation of vapor barrier, pipe boots, penetration sealing and tear sealing.

2. Inspect under slab vapor barrier installation, verify that pipes, conduits, floor drains and other penetrations have been sealed and lap seams taped in conformance with ASTM E 1643-11 and manufacturers published instructions.
3. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
4. Test and Inspection Reports shall be available to Architect upon request.

B. Stego Manufacturer's Field Services:
1. Provide technical assistance and guidance for installation of under-slab vapor barrier system.
2. Inspect installation and certify that product has been furnished and installed in accordance with manufacturer's published instructions.
a. Prepare and submit inspection report for each inspection made.

C. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

END OF SECTION 030586

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. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to constructing concrete formwork as described herein and/or as shown on the Drawings.
2. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to excavation and installation of spread and continuous footings as described herein and/or as shown on the Drawings.
3. Formwork for site work concrete is specified in other sections.

B. Related Documents:
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to Work of this Section.

C. Related Sections:
1. Section 030586 – Vapor Barrier.
2. Section 031106 – Void Forms.
3. Section 032000 – Concrete Reinforcement.
4. Section 033000 – Cast-in-Place Concrete.
5. Geotechnical Investigation Report: Furnished by Owner.

1.3 REFERENCES

A. The Work described in this Section, unless otherwise noted on the Drawings, or herein specified, shall be governed by the latest editions of the following Codes or Specifications.
1. ACI 301, Specifications for Structural Concrete of Buildings.
2. ACI 318, Building Code Requirements for Structural Concrete.
3. ACI 347R, Guide to Formwork for Concrete.

1.4 SYSTEM DESCRIPTION

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension. Design criteria shall conform to ACI 347R.

1.5 SUBMITTALS

A. Submit shop drawings in accordance with other sections.

B. Shop Drawings: Submit a diagram of proposed construction joints not indicated on Drawings prior to or concurrent with reinforcing steel shop drawings.
1. Shop drawings will be reviewed for proposed construction joint locations with respect to aesthetic criteria and general design conformance only.

C. Product Data: Submit complete manufacturer’s product data sheets for each specified product.

1.6 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 347R, ACI 301, and ACI 318.

B. Except when close coordination and fitting of various trades' work precludes allowance of tolerance, maximum total permissible deviations from established line, grades and dimensions shall conform to ACI 347R. Set and maintain forms in such manner as to ensure completed work within specified tolerance limits.
   1. Variation in location of embedded structural items unless provided with sleeves or other means of adjustment shall be a maximum of 1/4".

C. Footing installation Tolerances:
   1. Maximum lateral variation off of centerlines: 2".
   2. Plan Dimensions: Plus 3", minus 1/2".
   3. Thickness: Not smaller than scheduled sizes.
   4. Top of Footing Elevation: Plus 0", minus 3".

1.7 DELIVERY, STORAGE AND HANDLING

A. Form material shall be delivered to the job site as far in advance of its use as is practical, and shall be carefully stacked clear of the ground in such a manner as to facilitate air drying.

B. Store form materials and accessories on dunnage and under cover with protective sheeting.

C. Store void forms and installation instructions in manufacturer's packaging.

1.8 COORDINATION

A. Notify responsible trades of schedules of concrete pours to as to allow adequate time for installation and coordination of their work.

B. Schedule footing excavations such that reinforcing and concrete can be placed immediately after excavations are completed and inspected.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Forms: Wood, metal and other approved material that will not adversely affect surface of concrete and will provide or facilitate obtaining specified surface finish:
   1. Wood forms for unexposed concrete surfaces shall be built of No. 2 Southern Pine Lumber or other material of equal qualifications, of sufficient thickness to be capable of sustaining the loads to be imposed thereon, dressed to uniformly smooth contact surfaces and so constructed as to be readily removable.
   2. Wood forms for exposed concrete surfaces shall be constructed of moisture-resistant, concrete form sheathing, not less than five (5) ply, and at least nine-sixteenths inch (9/16") thick, with one smooth face.
   3. Metal forms shall be clean, unpainted and in good condition. Forms shall at all times be straight to provide members of the widths and depths required. Damaged or indented forms will not be acceptable.
   4. Rustications and bevels in exposed concrete shown on the Drawings shall be neatly formed. All rustication strips shall be milled so that the edges are smooth and free from sawmarks or other irregularities.

2.2 FORMWORK ACCESSORIES

A. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

B. Corner Chamfer: 3/4 inch polyvinyl chloride PVC form strip.

C. Form Ties:
1. Exposed concrete surfaces; shall be manufactured to allow a positive breakback of no less than one inch (1") inside the concrete surface. Ties shall be equipped with a plastic cone of not less than five-eighths inch (5/8") diameters and one inch (1") long which will completely cover the hole and prevent the leakage of any mortar.
2. Unexposed surfaces; shall be bolt rods or patented devices having a minimum tensile strength of three thousand (3,000) pounds when fully assembled. Ties shall be adjustable in length and free of lugs, cones, washers or other features which would leave a hole larger than seven-eighths inch (7/8") in diameter, or depressions back of the exposed surface of the concrete. Ties shall be of such construction that, when the forms are removed, there will be no metal remaining within one-inch (1") of the finished surface of the concrete.

D. Form Sealer: High performance, transparent, penetrating polyurethane sealer for wood forms.

E. Compressible Filler: Premolded plastic strips, non-asphaltic, ASTM D1752, Type 1.

F. Construction Joint Form: Manufactured key-joint form that produces smooth, flush surface joint.

G. Vapor Barrier: Plastic extrusion in accordance with Section 03 30 50 Vapor Barrier.

H. Waterstops: Synko-Flex Preformed Plastic Waterstop of Synko-Flex Products Co. or approved equivalent, meeting requirements of Fs SS-S-00210.

I. Void Form System: If required by Drawings, Void Forms to create a temporary support for placement of structural concrete over expansive soils shall be in accordance with Section 03 11 06 Void Forms.

PART 3 EXECUTION

3.1 EXAMINATION

A. Refer to Division 1, General Requirements – Execution, for additional requirements on Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
1. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 ERECTION

A. All concrete members shall be adequately shored to safely support all loads and lateral pressures outlined in “Recommended Practice for Concrete Formwork” (ACI 347R), without distortion, excessive deflection and other damage.

B. All necessary forms, centering, shores and molds shall be built to conform to the shapes, lines and dimensions of the various members of concrete construction, as shown or scheduled on the Drawings. They shall be sufficiently tight and so substantially assembled as to prevent bulging or the leakage of mortar. All forms shall be assembled to facilitate their removal without damage to the concrete.

C. Provide temporary openings at the bottom of cast-in-place walls, columns and elsewhere as required to facilitate cleaning, drainage and inspection.

D. Construct forms with such care as to produce concrete surfaces which will not have unsightly or objectionable form marks in exposed (concrete) surfaces. Lumber once used as forms shall have all contact surfaces thoroughly cleaned before reuse.

E. Soffits: If indicated on Drawings, form the soffits of grade beams, walls and slabs bearing on piers using a void form system.

F. Slab Voids: If indicated on Drawings, install forms continuous and tightly butted together. Cut forms tight around all projections. Prior to placing reinforcements, entire carton form area shall be covered with topping sheets secured with ¾” staples.

3.3 FOOTING EXCAVATION

A. Spread and continuous footings shall extend to and penetrate bearing materials shown of the Drawings.

B. The exposed subgrade soils shall be examined in the field by a geotechnical engineer or the testing laboratory to verify the strength and bearing capacity of the soils.

C. Excavations and footings shall be the size and shape as shown on the Drawings. The bottom of each excavation shall be level, undisturbed, free of water, caving material or any other foreign substance.

3.4 FORM TIES

A. Form ties shall be employed in such places and at such intervals as to securely hold the forms in position during the placing of concrete, and to withstand the weight and pressure of the wet concrete. Ties of a type intended to be entirely removed shall be coated with release agent to safeguard against damaging the concrete during such removal. The use of wire ties will not be permitted.

3.5 WOOD STRIPS, BLOCKINGS AND MOULDINGS

A. Place in the forms wood strips, blocking, moulding, nailers, etc., as required to produce the finished profiles and surfaces shown on the Drawings and to provide nailing for wood members or other features required to be attached to concrete surfaces in such manner. Coat wood strips, blocking and moulding with release agent.

B. Chamfers: All exposed external corners of concrete member shall have 3/4" chamfer

strips placed in the forms to relieve the angles.

3.6 FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.7 CONSTRUCTION JOINT

A. Except as otherwise specifically indicated on the Drawings, each concrete member shall be considered as a single unit of operation, and all concrete for the same shall be placed continuously in order that such unit will be monolithic in construction. Should construction joints prove to be absolutely unavoidable, the joints shall be located at or near the midpoints of spans.

B. Additional construction joints shall not be made under any circumstances without prior approval by the Architect. All construction joints must be either plumb or level. Provide appropriate keys and dowels in all construction joints, whether horizontal or vertical.

3.8 FORM CLEANING

A. Immediately before placing concrete, clean forms free of chips, wire clippings and other debris.

B. Clean formed cavities of debris prior to placing concrete.
1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.9 INSERTS AND ACCESSORIES

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

3.10 WALLS

A. Construct concrete walls to the heights, thicknesses and profiles shown on the Drawings. Provide temporary openings at the bottom of all wall forms to facilitate cleaning and inspection. Close such openings securely, immediately in advance of

pouring concrete in the wall forms. Provide appropriate keys and haunches in walls to receive free edge of concrete floors.

3.11 WATERSTOPS

A. Provide continuous waterstops in all joints below grade. Position waterstops accurately and support against displacement. Splice sections watertight in accordance with manufacturer's recommendations.

3.12 VAPOR BARRIER

A. Install vapor barrier under all concrete floor slabs on grade and elsewhere as indicated on drawings. Smooth subgrade to prevent protrusions that may cause damage or rupture of film.

3.13 MISCELLANEOUS

A. Construct forms for any and all items of concrete work required for or in connection with the satisfactory completion of the project, whether each such item is specifically shown or referred to or not.

B. Do not sleeve any columns, beams, slabs or joists unless such sleeves are indicated on the Structural Drawings, or are previously approved on Shop Drawings by the Structural Engineer.

3.14 REMOVAL OF FORMS

A. Forms shall not be removed until the concrete has adequately hardened and set. Clamps or tie rods may be loosened twenty-four (24) hours after the concrete is placed; ties, except for a sufficient number to hold the forms in place, may be removed at that time. Throughwall ties that are to be wholly withdrawn shall be pulled toward the inside face of the respective wall or beam. Cutting ties back from the face of the concrete will not be permitted, and care shall be exercised to avoid spalling concrete surfaces. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

B. Formwork for concrete members that support the weight of concrete shall remain in place until the concrete has reached 75% of its specified 28-day strength, unless otherwise specified or permitted.

C. Under normal conditions, the minimum period of time to be allowed to elapse before forms may be removed shall be as indicated in ACI 347R, but its observance shall not operate to relieve the Contractor of the responsibility for the safety of the structure. Deviations shall be submitted to and reviewed by the Architect prior to removal of forms.

D. When the temperature falls below forty degrees Fahrenheit (40 degrees F.), the forms shall remain in place an additional period equal to the time the structure has been exposed to such lower temperature. Adequate measures shall be taken to protect the concrete from cold weather conditions.

E. Adequately reshore members subject to additional loads during construction to support both member and construction loads in a manner that will protect member from damage.

F. When reshoring is required, the operations shall be planned in advance and shall be the responsibility of the Contractor.

G. Contractor shall pay for and have Testing Laboratory make additional test cylinders to confirm strength requirements for early form recovery. Reshore before removing original shoring. Reshoring shall remain in place until members have attained required compressive strength, or as long as required to support additional construction loads.

3.15 FORM REUSAGE

A. Thoroughly clean surfaces of forms and remove nails before reuse. Do not reuse damaged or worn forms. Inspect forms and re-tighten rustications. Remove traces of joint treatment and where required for taping joints, remove traces of release agent with appropriate solvents.

B. Recoat contact surfaces of forms and liners with a light spray coat of release agent. Do not apply until after joint treatment is complete.

3.16 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements, for additional requirements for a Contractor Quality Control Representative to perform contractor quality control inspections.
1. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
2. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
3. Test and Inspection Reports shall be available to Architect upon request.

B. Footing Excavations:
1. Soils Testing Laboratory shall inspect each footing excavation to determine that proper bearing stratum is obtained and utilized for bearing and that excavations are properly clean and dry before placing concrete.
2. Furnish complete footing log showing location, elevation of top of bearing stratum, footing size and depth, condition of the material, excavation properly clean and dry before placing concrete, reinforcement in compliance with the Contract Documents and any and all observed irregularities, deficiencies or deviations from the Contract Documents.
3. Footing excavation shall be scheduled such that the concrete can be placed immediately after inspection.

C. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

END OF SECTION 031100


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ARCHITECTS PROGRAMMERS PLANNERS

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. Pier top forms.
2. Pier and grade beam void forms.
3. Backfill retainers.

B. Related Documents:
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the Work of this section.

C. Related Sections:
1. Section 031100 - Concrete Forming.
2. Section 033000 - Cast-in-Place Concrete.

1.3 SYSTEM DESCRIPTION

A. Void Form System: Corrugated paper or plastic void form materials and accessories to properly create a temporary support for the placement of structural concrete over expansive soils.

1.4 SUBMITTALS

A. Division 1, General Requirements - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data indicating form materials, configurations and limitations.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer: Company specializing in manufacturing Products specified with minimum five (5) years documented experience.
2. Installer: Company specializing in performing the Work of this Section with minimum five (5) years documented experience.

B. Manufacturer Installation Instructions: Contractor shall maintain a current copy of void form manufacturer published instructions in Project Field Office and refer to installation instructions at all times during installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 1, General Requirements - Product Options: Transport, handle, store, and protect Products.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Accept Products on site in manufacturer's packaging. Inspect for damage. Return damaged Products and replace with undamaged Products.

D. Deliver Material Safety Data Sheet (MSDS) for each material to Project Field Superintendent for Contractor Records.

E. Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

F. Environmental Requirements: Place forms in clean dry grade beam excavation. Do not place forms if excavation is damp or wet. Do not place forms during rain or if rain is forecasted.

G. Water Spraying: Spraying water into grade beam excavation to clean top of previously placed pier not permitted. Clean top of pier concrete by means other than water. Keep void forms dry.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for Void Forms is based on the product named.
   1. SureVoid Products, Incorporated: www.surevoid.com.

B. Division 1, General Requirements - Product Options: Product options and substitutions. Substitutions: Permitted.

### 2.2 MATERIALS

A. Pier Top Forms: Suretop, Commercial. Cylindrical corrugated form that properly forms and contains upper portion of concrete piers.
   1. Composition: Waterproof corrugated plastic.
   2. Diameters: Slightly undersized to pier diameter indicated on Drawings.
   3. Length: Maximum 24 inches.

B. Grade Beam Void Forms: WallVoid. Rectangular form with panel flange used in-between the panels of grade beam form system. Panels are placed on flange to hold piece in place preventing it from floating up into grade beam during concrete placement.
   1. Function: To create void space directly under grade beams.
   2. Composition: Corrugated paper material with a moisture resistant exterior, having an interior fabrication of a uniform, cellular configuration, composed with components with wet-strength paper and wax impregnated medium/liners and moisture resistant adhesive (Extra Slow).
   3. Depth: Indicated on Drawings.
   4. Position: Between form panels.
   5. Strength: For wall height indicated on Drawings based on manufacturer's recommendations.
   6. Accessories:
      a. Seam Pads: Cover for void form joints to prevent moisture and concrete from flowing in between and into wall void interior.

b. End Caps: Covers exposed ends of void forms to prevent moisture and concrete from flowing into wall void interior.

C. Grade Beam Void Forms (Earth Formed Grade Beams): TrenchVoid. Rectangular form without flange used in bottom of trenched grade beam where earth is used to form beam. Width of form is same as trenched grade beam.
1. Function: To create void space directly under grade beams.
2. Composition: Corrugated paper material with a moisture resistant exterior, having an interior fabrication of a uniform, cellular configuration, composed with components with wet-strength paper and wax impregnated medium/liners and moisture resistant adhesive (Extra Slow).
3. Depth: Indicated on Drawings.
4. Position: Between form panels.
5. Strength: For wall height indicated on Drawings based on manufacturer's recommendations.
6. Accessories:
a. Seam Pads: Cover for void form joints to prevent moisture and concrete from flowing in between and into wall void interior.
b. End Caps: Covers exposed ends of void forms to prevent moisture and concrete from flowing into wall void interior.

D. Pier Void Forms: Sure Round PierVoid.
1. Function: To create void space adjacent to upper portion of drilled piers under pier cap.
2. Composition: Same as WallVoid.
3. Interior Profile: Pre-manufactured, non-field cut, sealed unit with curved, radial, vertical edge adjacent to pier, diameter as required for pier diameter.
4. Strength: Same as WallVoid.

E. Slab Void Forms: Sure Void System.
1. Forms shall be capable of supporting not less than 1200 psf or actual load from deep wall or beam without deflection.
2. Fiberboard void forms for beam soffits below grade and slab voids shall be rectangular forms manufactured by Sure Void products.
3. Topping sheet shall be ¼" masonite or fiberboard 275# Natural Wax Impregnated Sheet.
4. Prior to placing reinforcements, entire carton form area shall be covered with topping sheets secured with ¾" staples.

F. Backfill Retainers: SureRetainer. Impact resistant, high-density, polyethylene (HDPE) plastic designed to prevent migration of backfill material into voided area and used to permit compaction equipment to operate directly adjacent to grade beam.
1. Retainer Extension Above Top of Void Form: Minimum 4 inches.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Refer to Division 1, General Requirements – Execution for additional requirements on the Verification of existing conditions before starting Work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 PREPARATION/INSTALLATION

A. Assemble knock-down products in accordance with manufacturer's published instructions to develop designed strengths.

B. Keep forms dry before placing concrete. Remove forms that are wet and replace with new forms.

C. Keep water away from trenches. Trenches shall be kept dry.

D. Place only as many forms as can be installed and utilized in a reasonable amount of time during controlled concrete placement.

E. Install forms and accessories in accordance with manufacturer's published instructions.

F. Protect void forms from moisture, and replace wet or damaged pieces before placing concrete.

G. Immediately protect base of wall after forms have been stripped with backfill retainers. Retainers will keep backfill material from migrating into voided area.

H. Install backfill retainers in accordance with manufacturer's published instructions.

I. Install backfill retainers at base of wall, overlap and seal pieces together and attach retainers to concrete grade beam.

3.3 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements, for additional requirements for a Contractor Quality Control Representative to perform contractor quality control inspections.
   1. Inspect installation of void forms, form type, material and configuration.
   2. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
   3. Test and Inspection Reports shall be available to Architect upon request.

B. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

END OF SECTION 031106

# 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. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to placing reinforcing steel for cast-in-place concrete as described herein and/or as shown on the Drawings.
   2. Supports and accessories for steel reinforcement.

B. Related Documents:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to Work of this section.

C. Related Sections:
   1. Section 031100 – Concrete Forming.
   2. Section 033000 - Cast-in-Place Concrete.

## 1.3 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 301 – Specifications for Structural Concrete for Buildings.
   2. ACI 318 – Building Code Requirements for Structural Concrete.
   3. ACI SP-66 – ACI Detailing Manual.

B. American Society for Testing and Materials (ASTM):
   1. ASTM A 185 – Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
   2. ASTM A 615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   3. ASTM A 706 – Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.

C. Concrete Reinforcing Steel Institute (CRSI):
   1. CRSI MSP – Manual of Standard Practice.
   2. CRSI DET – Reinforcing Bar Detailing.

## 1.4 SUBMITTALS

A. Shop Drawings: Comply with requirements of ACI SP-66 and CRSI DET. Include installation drawings with complete bending diagrams, assembly diagrams for splicing and laps of bars, shapes, dimensions and details of bar reinforcing and accessories.
   1. Show diagrammatic elevations of walls at scale large enough to clearly show position and erection marks of marginal bars, around openings, dowels, splices, etc., for these bars.
   2. Show complete layout plan for each layer of reinforcing of slabs, beams and piers, showing number, arrangement, spacing, location, marking and orientations of reinforcement required for layer being described.

3. Show details of drilled pier reinforcement placement including support and centering methods.

B. Mill Test Reports: Certified copies, evidencing compliance with the requirements of these Specifications, shall be delivered to the Architect and Engineer with all deliveries of reinforcing steel.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301, ACI SP-66, and ACI 318.

B. Reinforcing steel shall be new domestic steel. Use of foreign or steel of undetermined origin not permitted.

C. Steel supplier shall furnish mill certificate reports for all reinforcing.
1. Mill Test Reports shall be available for review by Architect and Engineer at time of delivery.

1.56 DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcing to project site in bundles marked with metal tags indicating bar size, length and mark.

B. Contractor shall receive reinforcing at site, inspect reinforcing for specified requirements and verify contents of mill certificate. Contractor shall require tests as specified in Quality Assurance article if mill certificate is not provided with shipment.

C. Unload reinforcing carefully to prevent damage. Store above ground in dry, well drained area and protect from mud, dirt, paint, corrosion, etc.

D. Deliver pier reinforcing steel in 40 and 60 foot lengths.

PART 2 PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars: ASTM A615, new, deformed billet steel bars, Grade 60. All reinforcement specifically noted as being welded shall be domestic steel conforming to ASTM A706.
1. New deformed billet-steel bars.
2. Unfinished.

B. Reinforcement Accessories: Include spacers, chairs, bolsters, ties and other devices necessary for properly placing, spacing, supporting and fastening reinforcement in place, conforming to the requirements of CRSI DET and ACI SP-66. Metal accessories shall be plastic protected where legs will be exposed in finished concrete surfaces. Plastic protection shall be the color of the concrete.
1. Tie Wire: FS QQ-W-461, black annealed steel, minimum 16 gauge.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
a. Supports for reinforcement in concrete resting on earth or vapor barrier shall be pre-cast concrete briquettes, having tie wires embedded therein, or Individual High Chairs with bottom plates.

C. Mechanical Splices: Lenton Taper Threaded Rebar Splices - as manufactured by

ERICO Products or equal as submitted for approval.

2.2 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI MSP and ACI SP-66.

B. Locate reinforcing splices not indicated on Drawings at point of minimum stress in accordance with CRSI MSP and ACI SP-66.

C. Fabricate pier cages in 40 and 60 foot lengths ready for cutting to exact lengths as pier shafts are drilled.

PART 3 EXECUTION

3.1 EXAMINATION

A. Refer to Division 1, General Requirements – Execution for additional requirements on the Verification of existing conditions before starting Work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 PREPARATION

A. Cleaning: Before placing in work thoroughly clean reinforcement of loose rust, mill, scale, dirt, oil, and other coating which might tend to reduce bonding. Re-inspect reinforcing left protruding for future bonding, or following delay in work, and re-clean if necessary.

B. In case of fabrication errors, do not straighten or re-bend reinforcement so as to weaken or injure the material.

3.3 PLACEMENT – REINFORCING BARS

A. Bar Placement: In accordance with ACI 301, ACI SP-66, ACI 318, and CRSI MSP.

B. Bending: Bend bars cold; do not heat reinforcing or bend by makeshift methods. Discard bent, kinked or otherwise damaged bars.

C. Splices: In accordance with ACI SP-66 and the Contract Documents.

D. Placing: Reinforcement shall be accurately placed and securely saddle tied in accordance with CRSI recommended practice with No. 16 gauge black annealed wire, and shall be rigidly held in place during the placing of the concrete by means of metal chairs or spacers.
   1. Reinforcement in concrete walls shall be held in position, and to proper clearances, by means of concrete or metal spacers made especially for the locations where spacers are required.

2. Reinforcement in footings, beams and slabs shall be held to exact location during placing of concrete by spacers, chairs, or other necessary supports.

E. Supports: In accordance with ACI 301 and ACI SP-66 for number, type, spacing and placing.

F. Protection: Concrete cover over reinforcing steel shall conform to Structural Drawings or to ACI 318, Chapter 7.

G. Pier Cages: After each pier is drilled, the pier cage for that pier shall be cut to exact length and placed centered within pier shaft.
1. Splicing of pier cage reinforcing is Not Permitted in upper 5 feet of pier.
2. Bottom of pier cage shall be held in place above bottom of pier shaft as indicated on Structural Drawings.

H. Footing Reinforcing:
1. All steel reinforcing mats shall be completely fabricated in a rigid fashion in order to permit expeditious placement into the excavation with a minimum time delay.
2. Accurately place reinforcement in excavations, maintaining specified coverage. Secure to prevent displacement during concreting.

3.4 WELDING

A. No welding of reinforcing steel will be permitted unless specifically indicated on the Drawings.

B. Welding of reinforcing steel shall conform to AWS D1.4.

3.5 FIELD QUALITY CONTROL

A. Quality Control: Perform contractor quality control inspections.
1. Inspect reinforcement installation, steel type and grade, supports, spacers and ties before concrete placement.
2. Observe and report on placement of reinforcement, including size, quantity, vertical location, horizontal spacing, correctness of bends, splices, clearance between bars and forms, firmness of installation, and security of supports and ties, immediately prior to concreting.
3. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.
4. Test and Inspection Reports shall be available to Architect upon request.

B. Testing and Inspection Services – Testing Laboratory Services: Perform the following inspections and tests.
1. If reinforcing steel is purchased direct from a United States mill, manufacturer’s test sheets will be sufficient. Steel supplier shall furnish mill certificate reports.
2. If steel is from an undetermined origin or manufacturer’s test sheets or mill certificate reports are unavailable, perform tension and bending tests on three separate samples of each size of bar for every five tons of each type of steel as specified in the appropriate ASTM Specifications. Contractor shall furnish all material for testing and pay for all such tests.

END OF SECTION 032000

# SECTION 033000 – CAST-IN-PLACE CONCRETE

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to placing of concrete as described herein and/or as shown on the Drawings.
   2. Includes all cast-in-place concrete building members, and MEP equipment pads. Includes mixing, placing, and finishing.

B. Related Documents:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the Work of this section.

C. Related Sections:
   1. Section 033050 – Vapor Barrier.
   2. Section 031100 – Concrete Forming.
   3. Section 032000 – Concrete Reinforcement.

### 1.3 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 211.1, Standard Practice for Selecting Proportions of Normal, Heavyweight and Mass Concrete.
   2. ACI 301, Specifications for Structural Concrete for Buildings.
   3. ACI 302.2R, Guide for Concrete Floor and Slab Construction.
   4. ACI 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
   5. ACI 305R, Hot Weather Concreting.
   6. ACI 306R, Cold Weather Concreting.
   7. ACI 308, Standard Practice for Concrete Curing.
   8. ACI 309, Standard Practice for Consolidation of Concrete.
   9. ACI 311, ACI Manual of Concrete Inspection.
   10. ACI 318, Building Code Requirements for Structural Concrete.

B. American Society for Testing and Materials (ASTM):
   1. ASTM C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   2. ASTM C33, Standard Specification for Concrete Aggregate.
   3. ASTM C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   4. ASTM C94, Standard Specification for Ready-Mix Concrete.
   5. ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
   6. ASTM C143, Standard Specification for Slump of Portland Cement Concrete.

7. ASTM C150, Standard Specification for Portland Cement.
8. ASTM C172, Sampling of Freshly Mixed Concrete.
9. ASTM C260, Standard Specification for Air-Entraining Admixtures.
10. ASTM C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
11. ASTM C494, Standard Specification for Chemical Admixtures for Concrete.
12. ASTM C618, Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
13. ASTM E1155, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

1.4 SUBMITTALS

A. Mix Designs: The Contractor shall submit proposed mix designs in accordance with ACI 318.
1. Proportions of cement, including fly ash content, fine and coarse aggregates, and water.
2. Combined aggregate gradation.
3. Aggregate specific gravity and gradations.
4. Water-cement ratio, design strength, slump and air content.
5. Type of cement and aggregates.
6. Type and dosage of admixtures.
7. Special requirements for pumping.
8. Range of ambient temperature and humidity for which design is valid.
9. Any special characteristics of mix which require precautions in mixing, placing, or finishing techniques to achieve finished product.
10. Mix designs shall be accompanied with 30 strength test records not more than 24 months old in accordance with ACI 318, Table 5.3.2.1. If less than 30 test records are submitted, strength increases in accordance with the following will be required.
    a. Less than 30 tests but equal to or more than 15 tests: Table 5.3.1.2 and Table 5.3.2.1.
    b. Less than 15 tests: Table 5.3.2.2.
    c. No test records, no trial mixes and mix strength less that 5,000 psi: Section 5.4. Section requires a minimum strength of 1,200 psi greater than the specified strength.

B. Product Data: Submit manufacturers' data on manufactured products.
1. Air entrainment admixture.
2. Water reducing admixture.
3. Waterstop.
4. Expansion and control joints.
5. Sealants and waterproofing.
6. Reinforcing bars and wire mesh.
7. Vapor barrier.
8. Actual break-out of concrete materials if requested, (sand/gravel/cement).
9. Concrete accessories, complete.
10. Epoxy and grout.
11. Lumber.
12. Steel forms.
13. Anchors.
14. Architect may require additional information and or product material during construction. Provide when requested.

C. Shop Drawings: Submit a Control Joint and Construction Joint plan indicating proposed locations of control joints and construction joints in concrete floor slabs. Control joint and

construction joint plan shall be mechanically drawn to scale.

D. Test Reports:
1. Compressive strength tests for each set of test cylinders.
2. Slump test for each set of test cylinders.
3. Air content test for each set of test cylinders.
4. Unit weight test for each set of test cylinders.
5. Temperature test for each set of test cylinders.
6. Floor Flatness and Levelness tests.

E. Special Inspection Reports:
1. Special Inspection Reports: Submit inspection reports directly to Building Official and Architect from Independent Special Inspector with copy to Contractor in accordance with requirements of International Building Code, Section 1704 - Special Inspections, if required by the Building Official.

1.5 QUALITY ASSURANCE

A. Source Quality Control:
1. Concrete production facilities shall meet the requirement for certification by the National Ready Mixed Concrete Association.
2. Concrete batchers shall be completely interlocked semi-automatic or automatic batchers, as defined by the Concrete Plan Manufacturer's Bureau.
3. Concrete batchers shall have graphic, digital, or photographic recorders, which shall register both empty balance and total weight (or volume of water or admixture) of each batched material, time to the nearest minute, date, identification of batch, and numerical count of each batch. Copies of the record shall be furnished to the Testing Laboratory.

B. Qualifications:
1. Installer: Company specializing in concrete work specified with minimum five (5) years documented experience.
2. Concrete Samples and Slump Tests:
a. Testing Agency: Sample cylinders taken and slump test performed by Independent Testing Laboratory personnel.
b. Contractor: Sample cylinders and slump tests may be taken by Contractor if taken by person trained in concrete sampling and testing, and holding a current ACI Concrete Laboratory Technician - Grade 1 Certification. Submit certification to Architect as part of Qualification Documentation.

C. Perform work of this section in accordance with ACI 301 and ACI 318.

D. Acquire cement from same source and aggregate from same source for entire project.

E. Concrete Floor Slab Moisture Emission and Acidity:
1. Do not place or permit placement of underslab granular mat if building area subgrade pad is wet. Place granular mat only when building area subgrade pad area is dry.
2. Do not place or permit placement of underslab vapor barrier over granular mat if granular mat is wet. Place underslab vapor barrier only when granular mat is dry. Refer to Section 03 30 50 - Vapor Barrier.
3. Do not add water into transit-mixer at Project site before concrete placement unless instructed by Independent Testing Laboratory representative as specified in this Section.
4. Concrete Contractor is responsible for properly curing concrete floor slab to provide concrete floor slab with moisture emission and acidity test results

conforming to each floor material manufacturer requirements for moisture emission and acidity as specified in each floor material specification section when tested in accordance with ASTM F 1869. Refer to each floor material specification section for specific requirements.

1.6 PRODUCT DELIVERY, STORAGE, HANDLING AND SEQUENCING

A. Mix and deliver concrete to project ready-mixed in accordance with ASTM C94.

B. Schedule delivery so that continuity of any pour will not be interrupted for over 15 minutes.

C. Place concrete on site within 90 minutes after proportioning materials at batch plant.

D. Coordinate Work of this Section with work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the work of other Sections.

1.7 PROJECT CONDITIONS

A. Hot Weather Concreting:
1. Follow ACI 301 and ACI 305.
2. Provide retarding type admixture conforming to ASTM C494, Type A or D in accordance with manufacturer's recommendations.
3. Maximum concrete temperature shall not exceed 95 degrees F at time of placement.
a. With prior approval, Concrete with temperatures above 90 degrees F shall be placed only if a high range water reducer (super plasticizer) is added to the mix as directed the Testing Laboratory to maintain the specified slump during placement.

B. Cold Weather Concreting: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures.
1. Follow ACI 301 and ACI 306R.
2. When ambient temperature at site is below 40 degrees F or is expected to fall to that temperature within ensuing 24 hours, measures shall be taken so that the temperature of concrete will be between 55 degrees F and 85 degrees F at time of placement.
3. Once the concrete has been placed, it must be maintained at a temperature above 50 degrees F for minimum of 72 hours after placing.
4. Temperature Changes: Maintain changes in concrete temperature as uniformly as possible, but in no case exceed change of 5 degrees F per hour or 25 degrees F in any 24 hour period.
5. Combustion heaters shall not be used during the first 48 hours without precautions to prevent exposure of concrete and workmen to exhaust gases containing carbon dioxide and/or carbon monoxide.

C. Select admixture type (normal, retarder, or high early) best suited for concrete at the time of placing. The use of calcium chloride is specifically prohibited.

PART 2 PRODUCTS

2.1 FORMWORK

A. Standard Formwork: Specified in Section 03 11 00 - Concrete Forming.

2.2 REINFORCEMENT

A. Specified in Section 03 20 00 - Concrete Reinforcement.

2.3 CONCRETE MATERIALS

A. Cement/Fly Ash:
1. Portland Cement, Type I, conforming to the requirements of ASTM C150.
2. Fly Ash, Class C or F, conforming to the requirements of ASTM C618. The use of Fly Ash shall be subject to review by the Architect. Where Fly Ash is used in the mix design, Fly Ash shall comprise no more than 20% by weight of the total cementitious material in the mix. Fly Ash shall not be used in architecturally exposed concrete.

B. Aggregate:
1. Fine: ASTM C33; clean, hard, durable, uncoated, natural sand, washed, free of silt, loam or clay.
2. Coarse: ASTM C33; hard, durable, uncoated gravel, washed and screened without adherent coatings.
3. Coarse aggregate for structural lightweight concrete shall conform to the applicable requirements of ASTM C330 suitably processed, washed and screened, and shall consist of durable particles without coatings. Gradation in accordance with Size Designation 3/4 inch to No. 4, Table 1, ASTM C330.
4. Grading shall be in accordance with “Standard Method for Sieve Analysis of Sieve and Coarse Aggregates” (ASTM C136).

C. Water: ASTM C94, Paragraph 4.1.3; potable, clean and free from oil, acid and injurious amount of vegetable matter, alkalies, and other impurities.

2.4 ADMIXTURES

A. Cement-dispersing, water-reducing types. Admixtures shall conform to ASTM C494, Type A or D, and shall be used strictly in accordance with manufacturer’s recommendations and as determined by the Testing Laboratory. Admixture shall not discolor concrete or in any way affect the appearance of the concrete.
1. High-range water reducing admixture conforming to ASTM C494, Type F, may be used.

B. An air-entraining admixture conforming to ASTM C260 shall be used as required.

C. Use of calcium chloride is specifically prohibited.

2.5 CONCRETE ACCESSORIES

A. Non-Shrink Grout: Premixed, non-shrink, non-metallic, cement grout requiring only addition of water. Minimum compressive strength of 5,000 psi at 7-days and 7,500 psi at 28 days when placed at a plastic consistency of 115% flow factor.

B. Bonding Agent: ASTM C 1059, Type II acrylic non-redispersable type.

C. Vapor Barrier: Specified in Section 03 30 50 - Vapor Barrier.

D. 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.

E. Joint Filler: Non-extruding, resilient asphalt impregnated fiberboard or felt, complying with

ASTM D 1751, thickness as indicated on Drawings and width/depth as indicated.

F. Construction Joint Devices: Steel slab construction joints not permitted.

G. Sealant and Primer: Refer to Division 7: Thermal and Moisture Protection, for additional information regarding sealant and primer.

H. Miscellaneous Structural Metals Associated with Structural Concrete:
1. All structural steel pieces including miscellaneous structural metals placed in concrete exposed to weather, in permanent contact with soil, or accessible to salt intrusion shall be hot dipped galvanized in accordance with ASTM A123.
2. All structural steel pieces embedded in concrete shall conform to ASTM A36, unless noted otherwise on the Drawings.
3. Welding of inserts, anchors and other steel pieces used in conjunction with structural concrete shall conform to AWS D1.1.
4. Welding of reinforcing steel used in conjunction with structural concrete shall conform to AWS D1.4.
5. Headed stud anchors shall conform to ASTM A108, minimum tensile strength 60,000 PSI.
6. Concrete expansion anchors shall be wedge-type anchors, meeting the requirements of Federal Specifications FF-S-325, Group II, Type 4, Class 1, plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3. Size and location shall be as indicated on the Drawings.

I. Cure and Seal Compound: shall comply with ASTM C309. For concrete floors not to receive other finishes, use Ashford Formula to cure, seal and harden concrete.

2.6 CONCRETE MIX DESIGN

A. Strength: Concrete is classified and specified by ultimate compressive strength (f'c) at the age of 28 days.

B. Design concrete to ultimate compressive strengths (f'c) indicated on the Drawings.

C. Proportioning Concrete: Proportions of cement, aggregate, and water to attain required plasticity and compressive strength shall be in accordance with ACI 318. Do not make changes in proportions without submitting proposed changes to Testing Laboratory for evaluation.
1. Mix designs furnished by the concrete supplier, and accompanied by test data showing an acceptable strength history meeting the requirements of Method 2 as specified in section 3.8 of ACI 301.
   a. Temperature of concrete in test data shall be in within 5 degrees F of maximum temperature specified for this project.
   b. Strengths indicated in test data shall be in accordance with ACI 318, paragraphs 5.3 and 5.4.
   c. The specified strength of concrete used in supporting test data shall vary no more than 500 PSI plus or minus from that specified for this project.
2. The Testing Laboratory shall keep a strength history record of all concrete for the duration of the project as specified in this section.

PART 3 EXECUTION

3.1 GENERAL

A. Classes of Concrete and Usage: Concrete of the several classes required shall have the

characteristics shown on the Drawings.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
1. Verify lines, levels, and dimensions before proceeding with work of this section.
2. Verify that screeding equipment is calibrated to provide concrete slab to specified flatness and levelness requirements.

C. Inserts: Give the various trades and subcontractors ample notification and opportunity to furnish any and all anchors, nailers, pipes, conduits, boxes, inserts, thimbles, sleeves, frame vents, wires, supports, or other items required to be built into the concrete by the provisions of the Drawings or of the Specification governing the work of such trades and subcontractors, or as it may be necessary for the proper execution of their work. Obtain suitable templates or instructions for the installation of such items which are required to be placed in the forms.

D. Mixing:
1. Transit-mixed concrete conforming to the requirements of ASTM C94 and ACI 304 shall be used in lieu of concrete mixed at the job site. Concrete shall not be transported or used in any case after a period in excess of ninety (90) minutes has elapsed after the introduction of water into the mixer.
2. Indiscriminate addition of water to increase slump of concrete is prohibited. Add water only at the direction the Testing Laboratory. No water shall be added which increases the water cement ratio of the concrete in excess of the water cement ratio indicated on the approved mix design. At the direction of the Testing Laboratory the addition of a high range water reducing admixture may be used to retemper concrete.
3. The agency supplying transit-mixed concrete shall have a plant of sufficient capacity and adequate transportation facilities, to assure continuous delivery at the rate required. The frequency of deliveries to the site of the work must be such as to provide for placing the concrete continuously throughout any one (1) pour.

E. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner. Costs for correcting unsuitable conditions will be at Contractor’s expense.

## 3.2 PLACING CONCRETE

A. Place concrete in uniform layers, approximately horizontal, and not more than eighteen inches deep, exercising care to avoid vertical joints or inclined planes. The piling up of concrete in the forms in such a manner as to cause the separation or loss of any of its ingredients will not be permitted. Concrete which has partially set or hardened shall not under any circumstances, be deposited in the Work.

B. Place concrete in the forms as nearly in its final position as is practical to avoid rehandling. Deposit concrete in horizontal layers maximum 24 inches and in a manner to avoid inclined construction joints. Exercise special care to prevent splashing the forms or reinforcement with concrete. Remove any hardened or partially hardened concrete which has accumulated on the forms or reinforcement before the work proceeds. Do no place concrete on previously deposited concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the respective member of section, except as hereinafter specified.

C. Placing Concrete Slabs: Place and consolidate concrete slabs in continuous operation, within limits of construction joints, until completion of panel or section placement.

1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or derbies to smooth surface free of humps or hollows. Do not disturb slab surfaces before beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

D. Do not permit concrete to drop freely any distance greater than five feet (5'). Where longer drops are necessary, use a chute, tremie, or other acceptable conveyance to assist the concrete into place without separation. Do not pour directly into any excavations where water is standing.

E. Vibration: As soon as concrete is deposited, thoroughly agitate same by means of mechanical vibrators and suitable hand tools, so manipulated as to work the mixture well into all parts and corners of the forms and entirely around the reinforcement and inserts. Mechanical vibrators shall maintain frequencies in accordance with the recommendations of ACI 309, Table 5.1.4, and shall be operated by competent workmen. Over vibrating and use of vibrators to transport concrete within forms shall not be allowed. A spare vibrator shall be kept on job site during all concrete placing operations.

F. Conveying Concrete: Convey concrete from the mixer to the place of final deposit by methods which will prevent the separation or loss of the ingredients. Concrete to be conveyed by pumping shall be submitted to the Testing Laboratory for evaluation for each class of concrete shall be taken at the discharge end of the pumping equipment.

G. Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to assure a practically continuous flow of concrete at the delivery end without separation of the materials. The use of gravity-flow or aluminum chutes or conveyors for transporting concrete horizontally will not be permitted.

H. Bonding: Before depositing any new concrete on or against previously deposited concrete which has partially or entirely set, the surface of the latter shall be thoroughly roughened and cleaned of all foreign matter, scum and laitance. Coat surface of previously deposited concrete with a bonding agent per manufacturer's direction.

I. Construction Joints: Except as otherwise specifically indicated on the Drawings, each concrete member shall be considered as a single unit of operation and all concrete for the same shall be placed continuously in order that such unit will be monolithic in construction. Should construction joints prove to be absolutely unavoidable, same shall be located at or near the midpoints of spans. Additional construction joints shall not be made under any circumstances without prior review by the Architect and Structural Engineer.

J. Protect all freshly placed concrete from washing by rain, flowing water etc. Do not allow the concrete to dry out from the time it is deposited in the forms until the expiration of the curing period.

K. Refer to structural drawings for column base plate and other structural grouting requirements.

L. Grout shall be mixed only in such quantities as are needed for immediate use. No retempering shall be permitted and materials which have been mixed for a period exceeding thirty (30) minutes shall in no case be used upon any portion of the work.

M. Imperfect or damaged work, or any material damaged or determined to be defective before final completion and acceptance of the entire job, shall be satisfactorily replaced at

the Contractor's expense and shall be in conformity with all of the requirements of the Contract Documents. Removal and replacement of concrete work shall be done in such a manner as not to impair the appearance or strength of the structure in any way.

N. Cleaning: Upon completion of the work, all forms, equipment, protective coverings and any rubbish resulting therefrom shall be removed from the premises. Finished concrete surfaces shall be left in clean and perfect condition, satisfactory to the Owner. Sweep with an ordinary broom and remove all mortar, concrete droppings, loose dirt, mud, etc.

O. Separate slabs on grade from vertical surfaces with joint filler.

P. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

Q. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface.

R. Locate construction joints in coordination with floor slab pattern placement sequence. Provide keyways minimum 1-1/2 inches deep in grade beams and slabs.
1. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless indicated otherwise.

S. Screed floors level, maintaining surface Flatness and Levelness in accordance with the Architectural requirements.

3.3 FIELD QUALITY CONTROL

A. Quality Control: Quality Control Representatives shall perform contractor quality control inspections.
1. Inspect concrete placement, concrete pumping, leveling and screeding operations.
2. Check floor slab for compliance with specified Floor Flatness and Floor Levelness.
3. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
4. Test and Inspection Reports shall be available to Architect upon request.

B. Testing and Inspection Services:
1. Perform the following tests.
a. Compressive Strength Tests: Perform minimum one (1) test for each 100 cubic yards or fraction thereof, of each mix design of concrete placed in any one (1) day. Specimens for pumped concrete shall be taken at the discharge end of pumping equipment.
1) Test Cylinders: Mold and cure four (4) 6"x12" or five (5) 4"X8" specimens from each set of samples in accordance with ASTM C 31.
2) Tests: Each set of four (4) 6"x12" or five (5) 4"X8" cylinders.
One (1) 6"X12" or 4"X8" cylinder at seven (7) days for information.
Two (2) 6"x12" or Three (3) 4"x8" cylinders at twenty-eight (28) days.
One (1) 6"X12" or 4"X8" cylinder held in reserve for minimum fifty-six (56) days tested as directed.
b. Slump Tests: Perform one (1) slump test for each set of samples in accordance with ASTM C 143 or as directed by Architect.
c. Air Content Tests: Perform one (1) test for each set of samples in accordance with ASTM C 231 or ASTM C 173.

d. Unit Weight Tests: Perform one (1) test for each set of samples in accordance with ASTM C 138.
e. Temperature Tests: Measure temperature of concrete sample for each set of samples.
f. Floor Flatness and Levelness Tests: Perform tests using measuring equipment in accordance with ASTM E 1155.
g. Test Results: Testing Laboratory shall report test results in writing to Architect and Contractor within twenty-four (24) hours of test.

2. Inspections: Perform the following inspections.
   a. Batch Inspection and Monitoring Water: Inspect each batch of concrete, monitor addition of mixing water to assure uniform consistency from truck to truck. Check mixing from mixers before mix begins to set and within time limits set forth in ASTM C94.
      1) Monitor addition of water to concrete at job site and length of time concrete is allowed to remain in truck during placement.
      2) Certify each delivery ticket indicating class of concrete delivered, amount of water added and time at which cement and aggregate was discharged into truck, and time at which concrete was discharged from truck.
3. Test Procedures:
   a. Sample Technician: Test cylinders and slump tests performed only by person holding a current ACI Concrete Laboratory Technician - Grade 1 Certification.
   b. Sampling: Secure composite samples in accordance with ASTM C 172. Each sample shall be obtained from a different batch of concrete on a random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement.
   c. Pumped Concrete Samples: Specimens for pumped concrete shall be taken at the discharge end of pumping equipment.
   d. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
4. Test Reports:
   a. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
   b. Any deviations from the requirements of ASTM Specifications shall be recorded in the test report. Test concrete specimens in accordance with ASTM C 39.
   c. Should strength of concrete fall below the minimum, then additional tests, including load tests, may be required. These tests, if required, shall be made at Contractor’s expense and shall be in accordance with ASTM C42 and ACI 318. If tests do not meet applicable requirements, then structure, or any part of structure, shall be removed and replaced at Contractor’s expense.
   d. Test reports shall include but not be limited to the following information:
      1) Date of concrete placement.
      2) Concrete mix identification number or proportions of ingredients.
      3) Truck ticket number.
      4) Time test was made.
      5) Time of batching.
      6) Location of each placement.
      7) Slump.
      8) Unit weight and air content of concrete sampled.
      9) Date and results of strength test.
   e. Report promptly to Architect all details of reasons for rejection of any and all quantities of concrete. Give all information concerning locations of the

concrete pours, quantities, date of pours, and other pertinent facts concerning concrete represented by the specimens.

f. Any concrete testing requested by the Contractor for early formwork or shoring removal, etc., shall be at Contractor's expense.

g. Furnish a statistical analysis for each class of concrete placed on the project in accordance with ACI 214 and ACI 318. Information shall be updated and distributed once a month as directed by Architect. Information shall include, but not be limited to, the following:
   1) Strength test at seven (7) days.
   2) Strength tests at twenty-eight (28) days of two (2) cylinder averages.
   3) 28-day moving average strength tests of last three (3) test groups.
   4) Standard deviation and coefficient of variation based on twenty-eight (28) day strength tests.
   5) Average strength and number of twenty-eight (28) day tests for most recent month.

C. Testing and Inspection Services: Special Inspections.
   1. Perform Special Inspections as required by the International Building Code Section 1704 - Special Inspections as indicated on Drawings, if required by the Building Official.

3.4 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of Architect for each individual area.

D. Failed Strength Tests: If compressive strength tests indicate results below specified strength, Architect may require any or all of the following corrective measures be performed at Contractor's expense. Architect will determine extent of concrete removal if required.
   1. Change concrete mix.
   2. Core test in conformance with ASTM C 42.
   3. Load test on portion or portions of structure where test cylinders indicate concrete is below specified strength. Load testing performed in conformance with ACI 318.
   4. Remove and replace concrete below specified strength.

END OF SECTION 033000


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ARCHITECTS PROGRAMMERS PLANNERS

# SECTION 042000 - 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. Face brick (Numerous blends to match each building)
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.

B. Related Sections:
1. Section 033000 "Cast-in-Place Concrete" for dovetail slots for masonry anchors.
2. Section 047200 "Cast Stone Masonry" for furnishing cast stone trim.
3. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
4. Section 071900 "Water Repellents" for water repellents applied to unit masonry.
5. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
6. Section 089000 "Louvers and Vents" for wall vents (brick vents).

### 1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

### 1.4 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 Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
   1. Clay Masonry Unit Test: For each type of unit required, according to ASTM C 67 for compressive strength.
   2. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
   3. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
   4. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
   5. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.6 ACTION SUBMITTALS

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

B. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
   3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples:
   1. Colored mortar.
   2. Weep holes/vents.
   3. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
   4. Weep holes and vents.
   5. Accessories embedded in masonry.

1.7 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. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. 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.
      b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
      c. For exposed brick, include test report for efflorescence according to ASTM C 67.

d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. 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 Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. 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.

C. 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.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.

1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 48 inches high.
2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
3. Clean one-half of exposed faces of panels with masonry cleaner indicated.
4. Protect approved sample panels from the elements with weather-resistant membrane.
5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
   a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are

specifically approved by Architect in writing.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of typical wall area as shown on Drawings.
2. Build mockups for typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
   a. Include a sealant-filled joint at least 16 inches long in each exterior wall mockup.
   b. Include lower corner of window opening framed with stone trim at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
   c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
   d. Include metal studs, sheathing, building paper, building wrap, sheathing joint-and-penetration treatment air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
4. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
5. Protect accepted mockups from the elements with weather-resistant membrane.
6. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
   a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
   b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

## 1.9 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 designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and 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.

1.10 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold Weather Requirements: Comply with recommendations of IMIAWC (CW).
   1. Lay no concrete masonry unit when air temperature is below 40 degrees F unless materials are protected from weather and laid up in shelter. In such instances, maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.

E. Hot Weather Requirements: Comply with IMIAWC (HW).
   1. In temperatures exceeding 100 degrees F, do not lay out mortar beds ahead of placing units. Use a very light fog spray, not sufficient to penetrate masonry, on vertical surface of masonry to aid in mortar curing during that 24 hours after placing units.

1.11 COORDINATION

A. Coordinate Work with other trades in advance and make provisions for the installation of their work as masonry units are installed to avoid cutting and patching.

B. Coordinate masonry unit work with wall mounted lighting fixtures, plumbing items, openings and chases for heating ducts, plumbing pipes, electrical conduit and mechanical louvers or vents. Build into Work as construction progresses.

C. Provide for installation of bolts, toggles, flashing, beams, anchors, hangers, attachment strips, wall plugs and frames as required for support of structure and miscellaneous appliances.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, 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 in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

## 2.2 CONCRETE MASONRY UNITS

A. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

C. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
   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) ACM Chemistries; RainBloc.
      2) BASF Aktiengesellschaft; Rheopel Plus.
      3) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

D. Concrete Block: ASTM C 90, Grade N, Type 1, light weight, load bearing, hollow block.
1. Integral block admixture water repellent added during block manufacture.
2. Integral color admixture pigment added during block manufacture to produce a uniformly colored surface.
3. Size and Shape: Locations indicated on Drawings.
   a. 16 inches x 8 inches and nominal depth of 8 inches.
   b. 16 inches x 8 inches and nominal depth of 12 inches.
4. Exposed Face Texture: Selected by Architect.
5. Color: Selected by Architect.
6. Provide standard and fire rated unit

E. Concrete Block: Comply with referenced standards and as follows:
1. Size: Standard units with nominal face dimensions indicated on Drawings.
   a. 16 x 8 inches and nominal depth of 8 inches.
   b. Bullnose Units: Provide bullnose units at all interior corners, unless indicated otherwise on Drawings.
2. Load-Bearing Units: ASTM C 90, Grade N, Type 1, light weight.
   a. Hollow block.
   b. Exposed Faces: Manufacturer's standard grey color and texture.
3. Fire Rated Partitions: Units listed in UL FRD or permitted by Building Code.

2.3 MASONRY LINTELS

A. General: Provide one of the following:

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs 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.

2.4 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C 216.
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. Brick to match the adjacent walls in size and color.
   b. Brick colors will vary in “MSU” Blend. (Blends will vary at each building – see **Item #8** below).
2. Grade: SW.
3. Type: FBX.
4. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi.
5. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
6. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
7. Size: To match existing.
8. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork. Brick blends percentages will be owner approved on site from sample panels provided for each building.

**Bolin Science Hall**
Cameo, Coral, Kansas Gold, and Light Autumn

**Fain Fine Arts**
Cimarron, Kansas Gold, Light Autumn, Old Rose, and Terra Cotta

**Hardin Administration Building**
Cameo, Coral, Kansas Gold, Old Rose, and Terra Cotta

2.5 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted,

harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C 150, 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.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Masonry Cement: ASTM C 91.
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. Holcim (US) Inc.; Mortamix Masonry Cement or Rainbow Mortamix Custom.
   b. Lafarge North America Inc.; Magnolia Masonry Cement or Lafarge Masonry Cement.
   c. Lehigh Cement Company; Lehigh Masonry Cement or Lehigh White Masonry Cement.

F. Mortar Cement: ASTM C 1329.
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. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. 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.
   d. Color to match existing.

H. 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 to match existing.

I. Aggregate for Grout: ASTM C 404.

J. 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, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
   a. Euclid Chemical Company (The); Accelguard 80.
   b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
   c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

K. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same 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. ACM Chemistries; RainBloc for Mortar.
b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

L. Water: Potable.

## 2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
1. Interior Walls: Mill galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: 0.148-inch.
4. Wire Size for Cross Rods: 0.148-inch.
5. Wire Size for Veneer Ties: 0.148-inch.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry to meet the wall section requirements.
1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches wide, plus 1 side rod at each wythe of masonry 4 inches wide or less.
2. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

## 2.7 TIES AND ANCHORS

A. 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.

B. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of and an amplitude of 0.06 to 0.10 inch made from 0.030-inch- thick, steel sheet, galvanized after fabrication; to be used in limited fashion and location as approved by the Architect.

C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
3. Wire: Fabricate from 1/4-inch- diameter wire.

E. 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.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter wire.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch diameter, hot-dip galvanized steel wire.

F. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
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) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213 or D/A 210 with D/A 700-708.
2) Hohmann & Barnard, Inc.; DW-10, DW-10HS or DW-10-X.

## 2.8 EMBEDDED FLASHING MATERIALS

1. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
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) Hohmann & Barnard, Inc.; Flex-Flash.
2) Mortar Net USA, Ltd.; Total Flash.
b. Monolithic Sheet: Elastomeric thermoplastic flashing, 0.040 inch thick.
c. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch- thick coating of adhesive.
1) Color: Black.
d. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

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 with a drip.
4. Where flashing is fully concealed, use flexible flashing.

## 2.9 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, urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406] and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Weep/Vent Products: Use one of the following unless otherwise indicated:
1. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
a. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
1) Mortar Net USA, Ltd.; Mortar Net Weep Vents.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
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. Advanced Building Products Inc.;
b. Archovations, Inc.; CavClear Masonry Mat.
c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
d. Mortar Net USA, Ltd.; Mortar Net.
2. Provide the following configuration:
a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.

## 2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
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. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

## 2.11 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 masonry cement mortar unless otherwise indicated.

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.
   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 N.
   4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
   5. For interior non-load-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.
   1. Pigments shall not exceed 10 percent of portland cement by weight.
   2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
   3. Mix to match Existing.

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 Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 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 PREPARATION

A. Concrete Masonry Units:
   1. Lay only dry units, free of paint, oil, efflorescence or foreign matter.
   2. Remove laitance, loose aggregate or anything that prevents bonding to surface.

B. Reinforcement: Before being placed, remove loose coatings from reinforcement.

C. Use masonry saws to cut masonry units.

D. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

E. Direct and coordinate placement of metal anchors supplied for installation under other sections.

F. Verify holes and openings have been sealed to prevent escape of insulation.

### 3.2 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 work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. 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.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
1. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

H. Pattern Bond: Running bond with vertical joints located at centerline of masonry units in alternate courses unless noted otherwise on architectural drawings.

I. General:
1. Set units plumb, true to lien and with level courses accurately spaced within allowable tolerances.
2. Do not install cracked, broken or chipped masonry units exceeding ASTM allowable.
3. Adjust masonry unit to final position while mortar is soft and plastic.
4. Where adjustment must be made or if units are displaced after mortar has stiffened, remove units, clean joints and units of mortar and relay with fresh mortar.
5. Do not pound corners and jambs to fit stretcher units after they are set in position.
6. Adjust shelf angles to keep masonry level and at proper elevation.
7. Provide pressure relieving joints by placing continuous 1/8" foam pad under shelf angle.
8. Interlock intersections and external corners.

3.4 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.

## 3.5 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 to match existing; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than ½ Unit length. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking 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.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. 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.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-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 non-load-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 078446 "Fire-Resistive Joint Systems."

## 3.6 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and CMUs as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. 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.

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. Allow cleaned surfaces to dry before setting.
   3. Wet joint surfaces thoroughly before applying mortar.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
   1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

## 3.7 COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods:
   1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both withes or tab-type reinforcement.
b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.

2. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not over [8 inches] [12 inches] clear horizontally and 16 inches clear vertically.

B. Bond wythes of composite masonry together using bonding system indicated on Drawings.

C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.
1. Provide continuity with masonry joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.

E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
1. Provide individual metal ties not more than [8 inches] [16 inches] o.c.
2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
3. Provide rigid metal anchors not more than [24 inches] [48 inches] o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

## 3.8 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.

## 3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
   1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
   2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
   3. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
   4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally with not less than 1 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.

3.11 CONTROL AND EXPANSION JOINTS

A. Keep joints free of mortar by inserting continuous wood or metal temporary strips.

B. Install where indicated and at following locations:
   a. Changes in thickness, height and direction.
   b. Within 8'-0" of corners or offsets.
   c. At control or expansion joints in structure.
   d. At each side of openings greater than 24" wide.
   e. At foundation walls, shelf angles, setbacks and materials expanding at different ratios.
   f. Space joints at 30'-0" o.c. maximum in uninterrupted walls.
   g. Provide continuous vertical control joints through bond beams except at lintels above openings.
   h. Offset control joints to ends of lintels.

C. Install joint sealer as specified by Architect.

D. 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.

E. Form control joints in concrete masonry using one of the following methods:
   1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.
   3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
   4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

F. Form expansion joints in brick as follows:
   1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
   2. Build flanges of factory-fabricated, expansion-joint units into masonry.
   3. Build in compressible joint fillers where indicated.
   4. 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 079200 "Joint Sealants."

G. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.
   1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

## 3.12 LINTELS

A. Install steel lintels where indicated.

B. 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.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

## 3.13 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture 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 multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and through inner wythe to the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.
   3. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe.
   4. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
   5. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
   6. 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 079200 "Joint Sealants" for application indicated.
   7. 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 079200 "Joint Sealants" for application indicated.
   8. 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.
   9. 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.

10. 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.

E. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
1. Use specified weep/vent products to form weep holes.
2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes 24 inches o.c. unless otherwise indicated.
4. Space weep holes formed from wicking material 16 inches o.c.

F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

G. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

## 3.14 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

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

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more 48 inches.

## 3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors 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.

## 3.16 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 brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
   6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
   7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
   8. Clean stone trim to comply with stone supplier's written instructions.
   9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

## 3.17 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, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

# SECTION 047200 - CAST STONE 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. Cast stone trim including the following:

a. Window sills.
b. Lintels.
c. Surrounds; Arches; Accents Coins.

B. Related Sections:

1. Section 042000 "Unit Masonry" for installing cast stone units in unit masonry.

### 1.3 ACTION SUBMITTALS

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

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples:

1. For each color and texture of cast stone required, 10 inches square in size.
2. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicated types and amounts of pigments used.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364.

1. Provide test reports based on testing within previous two years.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute or the Architectural Precast Association.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Mockups: Furnish cast stone for installation in mockups specified in Section 042000 "Unit Masonry."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.7 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

## PART 2 - PRODUCTS

### 2.1 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364 and the following:

B. Portland Cement: ASTM C 150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast stone color indicated.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and colors.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable nonfading, and resistant to lime and other alkalis.

F. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.

1. Galvanized Coating: ASTM A 767/A 767M.

H. Embedded Anchors and Other Inserts: Fabricated from steel complying with ASTM A 36/A 36M, and hot-dip galvanized to comply with ASTM A 123/A 123M.

### 2.2 CAST STONE UNITS

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. Dallas Pre-Cast.

B. Regional Materials: Cast stone units shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

C. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.

1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

D. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

E. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch whichever is greater, but in no case by more than 1/4 inch.
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

F. Cure units as follows:

1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

a. No fewer than five days at mean daily temperature of 70 deg F or above.
b. No fewer than six days at mean daily temperature of 60 deg F or above.
c. No fewer than seven days at mean daily temperature of 50 deg F or above.
d. No fewer than eight days at mean daily temperature of 45 deg F or above.

G. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

H. Colors and Textures: Match existing units.

## 2.3 MORTAR MATERIALS

A. Provide mortar materials that comply with Section 042000 "Unit Masonry."

B. Regional Materials: Aggregate for mortar, cement, and lime shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

C. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

D. Hydrated Lime: ASTM C 207, Type S.

E. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

F. Masonry Cement: ASTM C 91.

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. Holcim (US) Inc.; Mortamix Masonry Cement.
b. Lafarge North America Inc.; Lafarge Masonry Cement, Magnolia Masonry Cement.
c. Lehigh Cement Company; Lehigh Masonry Cement.

G. Mortar Cement: ASTM C 1329.

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. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.

H. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. 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.

I. 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.

J. Water: Potable.

## 2.4 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from steel complying with ASTM A 36/A 36M, and hot-dip galvanized to comply with ASTM A 123/A 123M.

B. Dowels: 1/2-inch- diameter, round bars, fabricated from steel complying with ASTM A 36/A 36M, and hot-dip galvanized to comply with ASTM A 123/A 123M.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use

by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.

## 2.5 MORTAR MIXES

A. Comply with requirements in Section 042000 "Unit Masonry" for mortar mixes.

B. 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, masonry cement or mortar cement mortar unless otherwise indicated.

C. Comply with ASTM C 270, Proportion Specification.

1. For setting mortar, use Type N.
2. For pointing mortar, use 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 masonry cement or mortar cement by weight.
3. Mix to match Architect's sample.
4. Application: Use pigmented mortar for exposed mortar joints.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.
2. Application: Use colored aggregate mortar for exposed mortar joints.

## 2.6 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C 1364.

1. Include one test for resistance to freezing and thawing.

## 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 work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 SETTING CAST STONE IN MORTAR

A. Install cast stone units to comply with requirements in Section 042000 "Unit Masonry."

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints 3/8 to 1/2 inch wide unless otherwise indicated.
2. Build anchors and ties into mortar joints as units are set.
3. Fill dowel holes and anchor slots with mortar.
4. Fill collar joints solid as units are set.
5. Build concealed flashing into mortar joints as units are set.
6. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
7. Keep joints at shelf angles open to receive sealant.

E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

H. Provide sealant joints at copings and other horizontal surfaces, at expansion, control, and pressure-relieving joints, and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of width indicated, but not less than 3/8 inch.
4. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

## 3.3 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.

B. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.

C. Fill anchor holes with sealant.

1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.

D. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

E. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.

1. Form open joint of width indicated, but not less than 3/8 inch.

F. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

G. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

## 3.4 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.5 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

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

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 047200


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# SECTION 051200 – STRUCTURAL STEEL

## 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. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to installation of structural steel as described herein and/or as shown on the Drawings.

B. Related Documents:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the Work of this section.

C. Related Sections:

1. Section 05 21 00 – Steel Joist Framing.
2. Section 05 31 00 – Metal Deck.
3. Section 05 55 00 – Metal Fabrications.

### 1.3 REFERENCES

A. American Institute of Steel Construction (AISC):

1. AISC M016 – ASD Manual of Steel Construction.
2. AISC S303 – Code of Standard Practice for Steel Buildings and Bridges.

B. American Society for Testing and Materials (ASTM):

1. ASTM A 36 – Standard Specification for Carbon Structural Steel.
2. ASTM A 53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A 325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
4. ASTM A 108 – Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
5. ASTM A 500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
6. ASTM A 501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
7. ASTM A 992/992M – Standard Specification for Steel for Structural Shapes for Use in Building Framing.

8. ASTM C 1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
9. ASTM E 164 – Standard Practice for Ultrasonic Contact Examination of Weldments.

C. American Welding Society (AWS):

1. AWS A2.4 – Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 – Structural Welding Code - Steel.

D. Steel Structures Painting Council (SSPC):

1. SSPC 1 – Solvent Cleaning.
2. SSPC 3 – Power Tool Cleaning.
3. SSPC-Paint 15 – Steel Joist Shop Primer; Society for Protective Coatings.

## 1.4 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC M016.

B. Erector Qualifications:

1. Company specializing in performing structural steel erection work with minimum five (5) years documented experience.
2. A qualified installer who participates in the AISC Certification program and is designated an AISC Certified Erector, Category CSE at the time of bid.

C. Fabricator Qualifications:

1. Company specializing in performing structural steel fabrication work with minimum ten (10) years documented experience.
2. A qualified fabricator who participates in the AISC Certification program and is designated an AISC Certified Plant, Category STD at the time of bid.

## 1.5 SUBMITTALS

A. Division 1, General Requirements - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit producer’s or manufacturer’s specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Structural steel (each type), including certified copies of all mill reports covering chemical and physical properties.
2. High-strength bolts (each type), including nuts and washer.
3. Structural steel primer paint.
4. Non-shrink grout.

C. Shop Drawings:

1. Submit shop drawings prepared under the supervision of a registered

Professional Engineer licensed in the State in which the project is located in accordance with Specifications.

2. Show complete details and schedules for the fabrication and shop assembly of members. Detail to conform to AISC “Structural Steel Detailing”. Clearly indicate profiles, sizes, spacing and locations of structural members, connections, attachments, anchorages, framed openings, size and type of fasteners and cambers. Show AWS weld types.
3. Shop drawings shall include erections sequences, procedures, diagrams, schedules and compete details. Provide setting drawings, templates and directions for installation of anchor bolts and other anchorages to be installed by others. Any fabrication of material before review of shop drawings shall be at the risk of the contractor.
4. The Contractor shall completely outline a proposed method and sequence of erection to the Architect for review before delivering any material to the job site. The outline shall be prepared to avoid delay or any damage to the work of other trades.

D. Welder’s Certificate: Submit Welder’s Certifications performed by a qualified testing laboratory in accordance with AWS standards within the previous twelve (12) months.

E. Test Reports: The Testing Laboratory shall submit copies of reports of shop and field inspections and test performed in accordance with Specifications.

F. Special Inspection Reports: Submit the following inspection reports directly to Building Official and Architect from Independent Special Inspector with copy to Contractor in accordance with requirements of International Building Code, Section 1704 - Special Inspections, if required by the Building Official.

## 1.6 STORAGE OF MATERIALS

A. Storage of fabricated steel at the job site shall be the responsibility of the Contractor. Material stored at the job site shall be placed so that design loads on existing or newly constructed structures are not exceeded and members will not be distorted or otherwise damaged. All materials shall be protected against corrosion or deterioration of any kind.

B. The Architect/Engineer will reject any material that has become damaged because of improper storage.

# PART 2 PRODUCTS

## 2.1 MATERIALS

A. All materials shall be new and shall conform to the respective specifications (latest revision) and other requirements specified below.

1. Structural Steel Wide Flange and WT Shapes: ASTM A 992.
2. Structural Steel Angles, Channels and Plates: ASTM A 36.
3. Steel Pipe: ASTM A53, Type “E” or “S”, Grade B, or ASTM A501.
4. Steel Tube: ASTM A500, Grade B, 46, ksi.
5. Bolts: Erection bolts not specified as high strength shall meet requirements of ASTM A307, Grade A.
   a. High Strength bolts shall meet ASTM A325.
   b. Embedded Anchor Rods and Headed Bolts shall meet requirements of

ASTM F1554 Grade 36.

c. Nuts: ASTM A563 and ANSI B18.2.2.
d. Washers: ASTM F436.
e. Direct tension indicator bolts or load washers conforming to AISC Specifications for Structural Joints.

6. Welding Electrodes: AWS D1.1 for Series E70 electrodes.
7. Headed Stud Anchors: ASTM A108, minimum tensile strength 60,000 PSI.
8. Galvanizing: All items of structural steel noted to be galvanized shall conform to ASTM A123 (latest edition). All anchors, bolts washers, etc. in conjunction with galvanized surfaces shall also be galvanized to conform to these requirements.
9. Grout: Premixed non-shrink, non-metallic aggregate type, complying with ASTM C 1107 and capable of developing a minimum compressive strength of 7,500 psi at 28 days when placed at a plastic consistency of 115 percent flow factor.
10. Shop and Touch-up Primer: SSPC-Paint 15, Type I - Red Oxide.

## 2.2 FABRICATION

A. General:

1. All work shall be shop assembled to greatest extent possible and delivered to the project site complete and ready for erection. Material shall be properly marked and match-marked where field assembly is required. The sequence of shipments shall be such as to expedite erection and minimize field handling of material.
2. Steel Members shall be cambered if so indicated on the Drawings.
3. Steel members without specified camber shall be fabricated so that after erection, any minor camber due to rolling or fabrication shall be upward.

B. Connections:

1. Connections shall conform to the standard specifications of the AISC.
2. Connections not detailed on the Drawings shall be selected from Part 4 of the Manual of Steel Construction of the AISC.
3. Shop and field connections shall be bolted or welded as detailed.
4. No combination of bolts and welds shall be used for stress transmission in the same faying face of any connection.

C. Shop Welding:

1. All welding shall be done in accordance with AWS D1.1.
2. Intermittent and continuous welding shall be done in a manner to minimize internal stress.
3. Welds not specified shall be continuous fillet welds, sufficient to transmit required forces, using minimum fillet as specified by AWS D1.1.

D. Openings for other work: Provide openings in structural members only as shown on the structural drawings, or as directed by the Architect.

E. Shop Painting:

1. Shop paint structural steel work, except those members or portions of members to be embedded in concrete or mortar, or contact surfaces which are to be welded or high-strength bolted. Paint embedded steel on exposed

portions and initial 2" of embedded areas only. Do not paint steel surfaces which are to receive sprayed-on fire proofing.

2. Surface Preparation: Clean steelwork to be painted complying with SSPC SP 3. Remove oil, grease and similar contaminants, complying with SSPC SP-1.
3. Application: Immediately after surface preparation, apply one coat of structural steel primer paint according to manufacturer's instructions to provide a uniform dry film thickness of 2.5 mils. Provide full covering on joints, corners, edges and all exposed surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Refer to Division 1, General Requirements, for requirements on Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

1. Verify that conditions are appropriate for erection of structural steel and that Work may properly proceed.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 PREPARATION

A. Templates shall be secured in place to preclude misplacement of anchor bolts, and the bolts shall be installed at locations and with projections established on final structural steel shop drawings. Check correct positioning before concrete is placed.

B. Furnish items required to be cast into concrete or embed in masonry with setting diagrams to appropriate Sections.

3.3 ERECTION

A. Tolerances: Unless otherwise noted, structural steel shall be erected in accordance with AISC S303.

B. Temporary Bracing: Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb and in true alignment until completion of erection and installation of permanent bracing.

C. Do not field cut or alter structural members without approval of Architect and Structural Engineer.

D. Field weld components indicated on shop drawings.

E. After erection, prime welds, abrasions and surfaces not shop primed, except surfaces to be in contact with concrete.

F. Grouting of Base Plates and Bearing Plates: Plates shall be set and anchored to the proper line and elevation. Metal wedges, shims and/or setting nuts shall be used for leveling and plumbing of structural members, including columns. Concrete surfaces shall be rough, free of oil, grease and laitance, and shall be damp. Steel surfaces shall be clean and free of oil, grease and rust. Mixing and placing shall be in conformance with the material manufacturer's instructions. Grout shall be mixed by using a mortar mixer. Batches shall be of size to allow continuous placement of freshly mixed grout. Placing shall be quick and continuous. Exposed surfaces shall have smooth, dense finish.

G. Headed Stud Anchor Welding: All members or items to which studs are to be attached must be free of all foreign material, such as rust, oil, grease, paint, etc. When the mill scale is sufficiently thick to cause difficulty in obtaining proper welds it must be removed by grinding or sandblasting. Ceramic ferrules used in the stud welding process shall be completely removed.

## 3.4 FITTING OF STRUCTURAL MEMBERS

A. The Contractor alone shall be responsible for the correct fitting of all structural members and for the elevation and alignment of the finished structure.

## 3.5 ADJUSTMENTS

A. Any adjustments necessary in the steel frame because of fabrication, construction or erection discrepancies in elevation and alignment shall be the responsibility of the Contractor. Any modification to the approved manufactured material shall be approved by the Architect and Structural Engineer.

## 3.6 CONSTRUCTION

A. Interface with Other Work:

1. Meet with steel joist and pre-engineered metal building erector to coordinate connection requirements and scheduling for erection interface.

B. Site Tolerances:

1. Maximum Variation From Plumb: 1/4 inch.
2. Maximum Offset From True Alignment: 1/4 inch.

## 3.7 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements, for additional requirements on Quality Control: Contractor Quality Control Representative shall perform contractor quality control inspections.

1. Inspect structural steel member installation, sizes, configurations and connections.
2. Visually inspect field-welded connections.
3. Visually inspect bolted connections.
4. Document preparatory, initial and follow-up inspection in Contractor's Test and spection Reports.
5. Test and Inspection Reports shall be available to Architect upon request.

B. Contractor shall provide the Testing Laboratory with names of welder to be employed on work, during fabrication and erection, together with certification that each of these welders has passed qualifications tests within the last year, unless noted otherwise, in accordance with AWS Standards.

C. Inspect all structural steel during and after erection for conformance with Contract Documents and shop drawings. Any cases of insufficient bracing or guying, or other unsafe conditions shall be immediately called to attention of Contractor and reported to Architect.

1. No burning or other field corrections of steel members are permitted without express permission of Owner's representative. Immediately report violations.
2. Shop Inspection:
   a. Review shop drawings and shop procedures with fabricator's supervisory personnel.
   b. Request and obtain necessary mill certification of steel and verify proper material throughout the duration of the job, as required.
   c. Review welding procedures and welder operator qualifications for conformance to the technical requirements of the Specifications.
   d. Check layout and dimensions of jigs and fixtures for multiple fabrication, joint preparation, fit-up and run-out plates.
   e. Verify welding electrodes to be used and other welding consumables as job progresses.
   f. Check preheating procedure for uniformly and thoroughness through the full thickness of material.
   g. Make visual inspection of welding in progress for size, length and quality.
   h. Check bolted connections as required by the technical requirements of the Specifications.
   i. Perform random dimensional checks of completed members.
   j. Provide inspection of surface preparation for coating and coating operations.
3. Field inspection:
   a. Obtain planned erection procedure and review with erector's supervisory personnel.
   b. Check installation of anchor bolts and base plates.
   c. Verify field welding procedures and welder qualifications to assure conformance with the Specifications.
   d. Check steel as received in field for possible shipping damage, workmanship and piece marking.
   e. Check plumbness, alignment and chamber as erection progresses including proper bracing.
   f. Check joint preparation, fit-up, backing strips and runout plates.
   g. Check preheating to assure proper temperature, uniformity and thoroughness through the full material thickness.
   h. Review welding sequence.
   i. Visually inspect field welding for size, length and quality.

4. Inspection of High-Strength Bolted Construction shall be in accordance with the latest edition of AISC Specification for Structural Joints, and as follows:
   a. All high-strength bolted connections shall be visually inspected.
   b. At least two bolts of every third connection between floor beams and girders shall be checked with a calibrated torque wrench for proper torque.
   c. At least two bolts of every third connection between girders and columns shall be checked as above.

d. All bolts in every connection in the primary exterior framing and braced framing shall be checked as above.
e. All bolted connections that fail shall be corrected and all bolts in the connection shall be retested.
f. Check calibration of impact wrenches at least twice daily.

5. Inspection of all welds shall be in accordance with the latest edition of the AWS Structural Welding Code.
   a. Visually inspect all welds in accordance with AWS D1.1.
   b. All penetration column to base plate welds shall be inspected by ultrasonic testing in accordance with ASTM E-164.
   c. All full penetration welds in moment connections shall be inspected by ultrasonic testing.

6. Inspection of headed stud connector welding shall be in accordance with the latest edition of the AWS Structural Welding Code and as follows:
   a. Visual inspection of all studs shall indicate complete fusion and weld flush or fillet for 100 percent circumference. There will be no indication of lack of infusion or undercut weld.
   b. A minimum of two (2) shear studs shall be welded at the start of each production period in order to determine proper generator, control unit and stud welder setting. These studs shall be capable of being bent 45 degrees from vertical without weld failure. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud, such stud shall be struck with a hammer and bent 15 degrees off perpendicular to the nearest end of the beam. Studs failing under this test shall be replaced.

D. Refer to Division 1, General Requirements, for requirements on Testing and Inspection Services - Testing Laboratory Services: Special Inspections.

1. Perform Special Inspections as required by the International Building Code Section 1704 - Special Inspections, as indicated on Drawings and as required by the Building Official.

E. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

END OF SECTION 051200

# SECTION 052100 – STEEL JOISTS

## 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. Perform labor, materials, services and equipment as required to complete the steel joist and joist girder work indicated by the Contract Documents and furnish all supplementary items such as bridging, attached seats and anchors necessary for its proper installation.

B. Related Documents:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to Work of this section.

C. Related Sections:

1. Section 03 30 00 – Cast-in-Place Concrete.
2. Section 04 23 00 – Concrete Masonry Units.
3. Section 05 12 00 – Structural Steel.
4. Section 05 31 00 – Metal Deck.

### 1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 36 – Standard Specification for Carbon Structural Steel.
2. ASTM A 108 – Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.

B. American Welding society (AWS):

1. AWS D1.1 – Structural Welding Code - Steel.

C. Steel Joist Institute (SJI):

1. SJI (SPEC) – Standard Specifications Load Tables and Weight Tables for Steel Joists, Longspan Joists and Joist Girders.
2. SJI Technical Digest No. 9 – Handling and Erection of Steel Joists and Joist Girders.

D. Steel Structures Painting Council (SSPC):

1. SSPC SP 2 – Hand Tool Cleaning.
2. SSPC-Paint 15 – Steel Joist Shop Primer.

1.4 SUBMITTALS

A. Refer to Division 1, General Requirements - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:

1. Indicate joist types using standard SJI designations, spacing, location, bridging, anchorages and special conditions.
2. Indicate welded field connections using standard AWS welding symbols.
3. Indicate paint primer type, accessories and installation details.
4. Joist setting plan.

C. Assurance/Control Submittals:

1. Inspection Reports: Submit the following inspection reports directly to Architect from Independent Testing Laboratory with copy to Contractor.
   a. Testing Laboratory Inspection of steel joists.
2. Certificates: Submit certificate with shop drawings stating joists and joist girders are manufactured by a member of the Steel Joist Institute and conform to the requirements of the Steel Joist Institute Standard Specifications.
   a. Submit certified copies of mill test reports covering chemical and physical properties of steel used in work.
3. Welders Certificates: Certify welders to AWS standards within previous twelve (12) months.
4. Qualification Documentation: Upon request, submit documentation of experience indicating compliance with specified qualification requirements.

1.5 QUALITY ASSURANCE

A. Perform Work, including that for headers and other supplementary framing, in accordance with SJI Standard Specifications Load Tables and SJI Technical Digest No.9.

B. Qualifications:

1. Fabricator: Member in good standing of the Steel Joist Institute.
2. Erector: Company specializing in performing the work of this section with minimum five (5) years documented experience.
3. Welders: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed on Work have satisfactorily passed AWS qualification tests within previous twelve (12) months.

1.6 DELIVERY, STORAGE AND PROTECTION

A. Refer to Division 1, General Requirements - Product Options: Transport, handle, store and protect Products.

B. Transport, handle, store and protect products to SJI requirements.

C. Accept Products on site in manufacturer’s packaging. Inspect for damage. Return damaged Products and replace with undamaged Products.

D. Project Field Superintendent shall inspect Products immediately upon delivery to Project Site, determine Product conformance with specified requirements and reject Products not

complying with specifications. Project Field Superintendent shall direct that non-complying Products be removed from Project Site immediately.

E. Storage of fabricated steel at Project Site is responsibility of Contractor. Material stored at Project Site shall be placed so that design loads on existing or newly constructed structures are not exceeded and members will not be distorted or otherwise damaged.

F. Protect materials from corrosion or deterioration of any kind.

G. Architect/Engineer will reject any material that has become damaged because of improper storage.

## PART 2 PRODUCTS

### 2.1 MATERIALS

A. Open web Steel Joists and Joist Girders: As required by the Steel Joist Institute.

B. Structural steel for supplementary framing: Bearing plates, bridging, wall anchors, etc. ASTM A36.

C. Bolts for connections: ASTM A 325.

D. Welding Materials: AWS D1.1, type per Steel Joist Institute Specifications.

E. Shop and Touch-Up Primer: SSPC-Paint 15, Type I - Red Oxide.

### 2.2 EXTENDED ENDS

A. Extended ends shall have a load carrying capacity at least equal to the uniform load carrying the capacity of the joists specified or as indicated on the Drawings. Provide extended ends and joist extensions as shown on drawings.

### 2.3 BRIDGING

A. Provide member sizes and end anchorage in accordance with the Standard Specifications unless otherwise indicated in the Drawings. Use horizontal and diagonal bridging as required by SJI.

## PART 3 EXECUTION

### 3.1 FABRICATION

A. General: Contractor shall be responsible for errors in fabrication and for correct fitting of joists. Holes shall not be made or enlarged by burning, nor will burning of unfare holes in shop or field be permitted.

B. Joists: Join members by welding in a manner that will produce finished connection of strength required.

C. Accessories: Provide all necessary sag rods, bridging, extended ends, side wall and beam anchors, wall connectors, headers and ceiling extensions.

D. Painting: Scale, rust or other deleterious materials shall be removed from fabricated joists, bridging, anchors, etc., by SJI approved methods before shop coat of paint is applied.

## 3.2 ERECTION

A. General: Exercise care in handling and placing joists. Set joists to lines, levels and spacing as indicated. Execute general handling and erection in accordance with SJI Specifications. Minimum bearings and anchorage shall conform to SJI Specifications and/or Drawings. Do not start erection of joists until supporting Work is in place and connections made. Permanently fasten joists to supports and completely install all bridging and anchors before any construction loads are placed.

B. Allow for erection loads: Provide sufficient temporary bracing to maintain framing safe, plumb and in true alignment.

C. Bridging: Conform to requirements of Steel Joist Institute Standard Specifications and loads shown on the Drawings. Anchor each line of bridging to walls or supports and to each joist by welding or bolting. Do not permit erection of decking until joists are braced bridged and secured or until completion of erection and installation of permanent bridging and bracing.

D. Welding: Execute welding in accordance with “Code for Arc and Gas Welding in Building Construction” of American Welding Society as amended to date and only by welding operators who have been previously qualified to perform the type of work required.

E. Damaged Joists: Do not use joists with cracked or improper welds or joists otherwise damaged so as to affect their structural properties. Field repair of such damaged joists will be allowed only by special permission and subject to review of the Architect. Method of repairs shall be in accordance with manufacturer’s recommendations.

## 3.3 CONSTRUCTION

A. Interface with Other Work:

1. Coordinate placement of anchorages in concrete and masonry construction for making connections and for securing bearing plates.
2. Furnish anchor bolts and other devices built into concrete and masonry construction to responsible installer for installation.
3. Meet with structural steel and pre-engineered metal building erector to coordinate connection requirements and scheduling for erection interface.

B. Site Tolerances:

1. Minimum Variation From Plumb: 1/4 inch.
2. Maximum Offset From True Alignment: 1/4 inch.

## 3.4 PAINTING

A. Fabrication Painting: Reference Paragraphs 2.1 E and 3.1 D.

B. Field Touch-Up Painting: Prepare and coat welds, fasteners, burned and abraded areas

as noted under Fabrication Painting.

## 3.5 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements for Quality Control: Contractor Quality Control Inspector shall perform contrctor quality control inspections.

1. Inspect joist installation, type, spacing and connections to structure.
2. Visually inspect all field-welded connections.
3. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
4. Test and Inspection Reports shall be available to Architect upon request.

B. Refer to Division 1, General Requirements for Testing and Inspection Services: Perform the following.

1. Inspect shop fabrication and field fabrication and erection at all times during process of Work. Inspect all connections of both bolted and welded types.
2. Inspect erection of steel joists and joist girders for proper installation. Inspection shall include checking for proper bearing, welding, bolting and installation of bridging.

C. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

END OF SECTION 052100


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# SECTION 053123 – METAL ROOF DECK

## 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. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to installation of steel roof deck as described herein and/or as shown on the Drawings including type of deck, layout and orientation.
2. Welds and mechanical fastener types, sizes and patterns.
3. Supplemental framing for openings.

B. Related Documents:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to Work of this section.

C. Related Sections:

1. Section 05 12 00 – Structural Steel.
2. Section 05 21 00 – Steel Joist Framing.

### 1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A36 – Standard Specification for Structural Steel.
2. ASTM A611 – Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled.
3. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
4. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
5. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
6. ASTM C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. American Institute of Steel and Iron (AISI):

1. North American Specification for the Design of Cold-Formed Steel Structural Members, 2004 Supplement.

C. American National Standards Institute (ANSI):

1. Safety Requirements for Powder-Actuated Fastening Systems (ANSI A10.3).

D. American Welding Society (AWS):

1. Structural Welding Code – Steel (D1.1).
2. Structural Welding Code – Sheet Steel (D1.3).
3. Standard Symbols for Welding, Brazing and Nondestructive Examination (A2.4).

E. Department of the Army, Navy and the Air Force:

1. Technical Manual – Seismic Design for Buildings (TM 5-809-10, NAVFAC P-355, AFM 88-3, Chapter 13).

F. Factory Mutual (FM):

1. Building Materials Approval Directory.
2. Standard Class No. 4450 – Class I Insulated Steel Roof Decks.

G. International Code Council Evaluation Service (ICC ES):

1. Uniform Building Code (UBC).
2. International Building Code (IBC).
3. Acceptance Criteria for Steel Decks (AC 43).
4. Steel Deck Diaphragms Attached with Hilti X-ENP-19 L15, X-EDN19-THQ12 or X-EDNK22-THQ12 Fasteners and Self-Drilling Screws, Button Punches or Top Seam Welds (ESR-2197).
5. Steel Deck Diaphragms (ESR-2199).

H. Steel Deck Institute (SDI):

1. Diaphragm Design Manual – Design Manual for Composite Decks, Form Decks and Roof Decks, Latest Edition.
2. Manual of Construction with Steel Deck.
3. Standard Practice Details.
4. Deck Damage and Penetrations.

I. Steel Joist Institute (SJI):

1. Standard Specification Load Tables and Weight Tables for Steel Joist and Joist Girders, 40th Edition.

J. Underwriters Laboratories (UL):

1. Roofing Materials and Systems Directory.
2. Fire Resistance Directory, Volume 1.
3. UL Standard 580 – Tests for Uplift Resistance of Roof Assemblies.

## 1.4 SYSTEM DESCRIPTION

A. Design Requirements: Provide adequate diaphragm shear resistance, uplift resistance and stiffness for imposed load combinations.

B. Performance Requirements: FM classified Class I-90 minimum for uplift resistance and UL fire classified.

## 1.5 SUBMITTALS

A. General: Submittals shall be in accordance with Conditions of the Contract and refer to Division 1, General Requirements, for Submittal Procedures.

B. Shop Drawings Include:

1. Deck layout and orientation, supporting steel framing and supports with dimensions and section details.
2. Deck type and profile, dimensions, supports, projections, openings and reinforcement.
3. Welds and mechanical fastener types, sizes and patterns.
4. Sidelap connector types, sizes and patterns.
5. Accessory details.

C. Design Data Includes:

1. Calculations in accordance with SDI design methods or approved alternative method verifying allowable diaphragm shears and stiffness.
2. Weld and mechanical fastener performance data including ultimate tension and shear loads and flexibility factors.

D. Assurance/Control Submittals:

1. Inspection Reports: Submit the following inspection reports directly to Architect from Independent Testing Laboratory with copy to Contractor.
   a. Testing Laboratory Inspection of steel deck.
2. Fastener Inspection Reports: Submit the following inspection reports directly to Architect from fastener manufacturer Quality Control Representative with copy to Contractor.
   a. Manufacturer inspection of mechanical fasteners.
3. Welders Certificates: Certify welders to AWS standards within previous twelve (12) months.
4. Qualification Documentation: Upon request, submit documentation of experience indicating compliance with specified qualification requirements.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Steel Roof Deck Manufacturer: Member producer of SDI.
2. Mechanical Fastener Manufacturer: Member producer of SDI and ISO 9001 accredited for manufacturing quality control.

B. Qualifications:

1. Company specializing in performing the work of this Section with minimum five (5) years of documented experience.
2. Welders: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed on Work have satisfactorily passed AWS qualification tests within previous twelve (12) months.
3. Powder or Air Actuated Fastener Installers: Tool operator licensed by pin manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Steel Deck:

1. Do not rack, bend or mar steel deck sheets.
2. Store steel deck sheets and accessories above ground and protected from free weathering with one end elevated.
3. Cover and ventilate unpainted or uncoated steel deck sheets until final installation.
4. Architecturally exposed steel deck sheets shall be appropriately packaged or protected to prevent damage during delivery, storage and handling.

B. Welding Electrodes and Mechanical Fasteners:

1. Store welding electrodes, mechanical fasteners and powder-actuated boosters in original packages in a cool, dry location until final installation.
2. Comply with all project and national safety regulations regarding handling of welding equipment and powder-actuated fastening systems.

C. Sidelap Connectors:

1. Store connectors in original packages in a cool, dry location until final installation.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Steel Roof Deck:

1. Vulcraft.
2. Verco Manufacturing Company.
3. Wheeling Corrugating Company.
4. Approved alternative.

B. Mechanical Fasteners:

1. Hilti, Inc.
2. Other approved alternative.

C. Sidelap Connectors:

1. Self-drilling metal screws:
   a. Hilti, Inc.
   b. Elco Textron.
   c. Other approved alternative.

2.2 MATERIALS

A. Steel Roof Deck:

1. Decking: Indicated on Drawings.
2. Galvanized steel: ASTM A653 – SS Designation, Grade 33 with minimum yield strength 33 ksi.
3. Cold rolled steel:

a. ASTM A611 – Grade C with minimum yield 38 ksi.
b. ASTM A446 – Grade A with zinc coating in accordance with ASTM A525 G60.

B. Welds and Mechanical Fasteners:

1. Welds:
   a. Material: Electric shielded arc process using minimum E60 XX electrodes in accordance with AWS D1.3 procedures.
   b. Weld Quality: All welds uniform size and appearance and free of pinholes, porosity, undercutting or other defects.
   c. Weld Size: Minimum ¾ inch effective diameter.
   d. Weld Washers: Use on steel deck thinner than 22 gauge.
2. Mechanical Fasteners:
   a. Material: AISI 1070 modified.
   b. Hardness: Minimum Rockwell Hardness C 54.5.
   c. Strength: Minimum tensile strength 285 ksi; minimum shear strength 175 ksi.
   d. Design and Manufacture: Knurled shank with forged ballistic. Manufacturing process shall ensure steel ductility and prevent development of hydrogen embrittlement.
   e. Washers:
      1) For bar joist framing: Minimum 12 mm (0.472 in.) steel washers.
      2) For structural steel framing: Minimum 15 mm (0.591 in.) steel washers.
   f. Corrosion Resistance:
      1) For steel decks with waterproofing membrane: 5 mm zinc electroplated in accordance with ASTM B633 SC1 Type III.
      2) For exposed steel decks: Minimum AISI 304 stainless steel sealing caps with bonded neoprene washer shall be installed over each fastener.
   g. Design Requirements:
      1) SDI diaphragm shear and flexibility.
      2) FM wind uplift resistance.
      3) UL fire classification.
   h. Approved Types:
      1) For use with bar joist framing supports with top chord thickness 1/8 inch to 3/8 inch:
         a) Hilti X-EDNK22 THQ12 (1/8 inch up to, but not including ¼ inch).
         b) Hilti X-EDN19 THQ12 (greater than 3/16 inch up to and including 3/8 inch).
         c) Other approved alternative.
      2) For use with structural steel framing supports with top flange thickness ¼ inch or thicker:
         a) Hilti X-ENP-19 L15 (1/4 inch or thicker).
         b) Other approved alternative.

C. Sidelap Connectors:

1. Acceptable types of sidelap connectors:
   a. Top or side seam welds
      1) 1-1/2 inch long fillet welds in accordance with AWS D1.3 procedures.
   b. Self-metal drilling screws:

1) Drive self-metal drilling screws completely through adjacent lapped deck sheets to achieve positive engagement of adjacent sheets with a minimum of three thread penetration.
2) Material: AISI 1022 modified.
3) Hardness: Minimum Rockwell Hardness B 59.5.
4) Strength: Minimum tensile strength 62 ksi; minimum yield 34 ksi.
5) Design and Manufacture: High hex washer head undercut with reverse serrations; pilot point at center.
6) Corrosion Resistance:
   a) For steel decks with waterproofing membrane: 5 mm zinc electroplated in accordance with ASTM B633 SC1 Type III.
   b) For exposed steel decks: AISI 410 or 304 stainless steel with bonded neoprene washer.
7) Design Requirements:
   a) SDI diaphragm shear and flexibility.
   b) FM wind uplift resistance.
   c) UL fire classification.
8) Approved Types:
   a) Hilti S-MD 10-16 x 7/8 HHWH Pilot Screw.
   b) Hilti S-MD 12-14x 1 HHWH Stitch Screw.
   c) Hilti S-MD 10-16 x ¾ HWH #3 Stainless Steel Screw.
   d) Other approved alternative.

c. Button punch:
1) Button punches shall be deep and positively engage the male and female side edges of adjacent interlocking deck sheets.

## 2.3 ACCESSORIES

A. Weld Washers: Flat washers with thickness between 0.05 and 0.08 inch with a minimum prepunched hole of 3/8 inch diameter.

B. Verco Sheartranz II (or Sheartranz) restraining elements: ASTM A653 – SS Designation, Grade 33 with minimum yield strength 38 ksi, 16 gauge. Used with Verco HSB-36 (or HSB-36-SS) steel roof deck at shear collecting support elements perpendicular to the deck corrugations. Install restraining elements in accordance with manufacturer's instructions and ICC ES ESR-2199 as shown on the Drawings.

## 2.4 FINISHES

A. As noted on Drawings:

1. Prime Painted Finish: Acrylic primer applied to thoroughly cleaned and etched steel. Rust inhibitive primer roller applied and oven cured to thickness 4 mm nominal each side.
2. Galvanized Finish: Zinc coated in accordance with ASTM A525 G60 with factory prime paint coat.

# PART 3 EXECUTION

## 3.1 INSTALLERS

A. Qualifications:

1. All steel deck welders AWS certified for welding of sheet steel.
2. All mechanical fastener installers certified or licensed by the fastener and tool system manufacturer on the project site. Certification or licensing includes all training necessary for proper tool operation, fastener selection, maintenance and troubleshooting.

B. Experience:

1. Minimum experience with three projects of similar size and type with chosen installation method.

C. Compliance:

1. Comply with all manufacturer catalog and carton installation instructions, product data and technical bulletins.

3.2 PREPARATION

A. Examination: Examine condition of supporting steel framing. Confirm location and elevation of supporting steel framing with the Drawings.

B. Layout: Place steel deck sheets as shown on the Drawings ensuring bearing on supporting steel framing. Sheets shall be true and straight with horizontal deviations less than 1/4 inch in 100 feet. Minimum endlaps 2 inches.

C. Marking: Mark steel deck at the centerline of supporting steel members to prevent weld burn through and mechanical fastener punch through. Use a chalk line or indelible marker.

D. Test Fastenings:

1. Welds: Perform project specific test welds prior to final installation. Test welds are considered an example of representative work.
2. Mechanical fasteners: Gauge pneumatic or powder actuated tool systems to the base material steel type and deck type and thickness prior to final installation. Confirm appropriate power regulation, powder actuated booster load and compressor air pressure prior to final installation.

3.3 INSTALLATION

A. Install steel deck sheets and accessories in accordance with manufacturer’s instructions and as shown on the Drawings.

B. Secure steel deck to supporting steel framing with welds or mechanical fasteners. Install welds or mechanical fasteners at the spacing and pattern as shown on the Drawings.

C. Secure steel deck sidelaps at the spacing and pattern as shown on the Drawings.

D. End closures of the deck units shall be fastened by tack welding or sheet metal screws not more than 48 inches apart.

E. Where deck changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches on center maximum.

F. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

G. Position drain pans with flange bearing on top surface of deck. Weld at each deck flute.

## 3.4 REPAIR / RESTORATION

A. Welds: Repair all portions of the steel deck coating damaged due to weld heat with compatible paint type or zinc rich compound. Repair burn throughs in accordance with SDI Deck Damage and Penetrations.

B. Mechanical Fasteners: Replace or supplement underdriven and over driven fasteners with adjacent, properly installed fasteners.

## 3.5 OPENINGS

A. At deck openings provide steel angle reinforcement indicated on Drawings. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and weld to deck at each flute.

B. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.

## 3.6 HANGING LOADS

A. Mechanical equipment or other loads shall not be hung from metal deck unless specifically indicated and detailed on Drawings. Method of attachment subject to review by Architect and Engineer.

## 3.7 FIELD QUALITY CONTROL

A. Welds: Examination and qualification of puddle and fillet welds shall be in accordance with AWS D1.3 criteria.

B. Mechanical Fasteners: Examine fastener washers to ensure steel deck is clamped to the supporting steel framing. Periodically examine fastener nail head standoff with template or gauge to within manufacturer accepted tolerances.

C. Quality Control: Contractor Quality Control Representative shall perform contractor quality control inspections.

1. Inspect steel deck installation, layout, types, gauge, finish and sizes of decking sheets, connections and tolerances, and welding.
2. Document preparatory, initial and follow-up inspection in Contractor’s Test and Inspection Reports.
3. Test and Inspection Reports shall be available to Architect upon request.

## 3.8 SAFETY

A. Do not use steel deck sheets for storage or working platform until permanently fastened to supporting steel framing.

B. Do not exceed construction load carrying capacity of steel deck sheets for type and span defined in SDI Construction Load Tables.

C. Cordon off the Controlled Decking Zone (CDZ) area and all areas below steel deck sheets being fastened during installation.

END OF SECTION 053123


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SECTION 054100

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. Furnish all labor, materials, services and equipment as required in conjunction with or properly incidental to installation of Load bearing formed steel stud framing, 20 gage and heavier as described herein and/or as shown on the Drawings.
2. Exterior wall framing.
3. Formed steel joist framing.

B. Related Documents:
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, General Requirements, apply to the Work of this section.

C. Related Sections:
1. Section 051200 – Structural Steel.
2. Section 055000 – Metal Fabrications.
3. Division 7, Thermal Protection – Blanket Insulation: Insulation within framing members.
4. Division 9, Finishes – Plaster and Gypsum Board Assemblies: Gypsum Wall Assemblies.
5. Division 9, Finishes – Supports for Plaster and Gypsum Board: Non-Structural metal framing.
6. Division 13, Special Construction – Pre-Engineered Metal Buildings: Building structural frame and metal wall panels.

1.3 REFERENCES

A. American Iron and Steel Institute (AISI):
1. AISI SG-971 – Specification for Design of Cold-Formed Steel Structural Members.

B. American Society for Testing and Materials (ASTM):
1. ASTM A 307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
2. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
3. ASTM A 1003 - Standard Specification for Steel Sheet, Carbon, Metallic-and Nonmetallic-Coated for Cold-Formed Framing Members.
4. ASTM B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
5. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.
6. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases

to Wood Studs or Steel Studs.

7. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

C. American Welding Society (AWS):
1. AWS D1.3 – Structural Welding Code – Sheet Steel.

1.4 SYSTEM DESCRIPTION

A. Component Design: Comply with AISI Specification for Design of Cold-Formed Steel Structural Members, latest edition.

B. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic, day and night, temperature ranges.

C. Maximum Allowable Deflection: 1/360 for non-masonry finishes and 1/600 for masonry finish.

D. Design system to accommodate construction tolerances, deflections of building structural members, and clearances of intended openings.

1.5 SUBMITTALS

A. Shop Drawings:
1. Submit shop drawings for components and installations not fully dimensioned or detailed in manufacturer's product data.
2. Include placing drawings for framing members showing size and gage designations, number, type, location, and spacing.
3. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for installation.
4. Indicate welded connections.

B. Product Data: Submit data on standard framing members; describe materials and finish, and product criteria.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in structural framing and components of this section with five (5) years minimum documented experience.

1.7 PRODUCT HANDLING

A. Division 1, General Requirements - Product Options: Transport, handle, store, and protect Products.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Metal Framing:
1. United Steel Systems.
2. Clark Dietrich Building Systems.
3. Unimast Incorporated.
4. Dale/Incor.

B. Wall or Partition Floor Track Anchorage Devices:

1. Hilti, Incorporated.
2. Simpson Anchor Systems.
3. Powers Fastening, Incorporated.

2.2 MATERIALS

A. Studs, Joists and Track: ASTM A 1003, ASTM C 955.
1. Gage and Depth: Indicated on Drawings.
a. Studs: Steel formed to channel shape with punched web; U-shaped track in matching nominal width and compatible height.
b. Joists: Formed steel to channel shape, solid web.
c. Track: Formed sheet steel; channel shaped; same width as studs, tight fit, solid web.
2. Galvanized Coating: G60 minimum.

B. Bracing, Furring, and Bridging: Formed sheet steel, thickness determined for conditions encountered, finish to match framing components.

C. Plates, Gussets, and Clip Angles: Formed sheet steel, thickness determined for conditions encountered, finish to match framing components.

D. Headers: Use Joists; quantity and alignment as indicated on drawings. Finish to match framing components.

E. Touch-Up Primer for Galvanized Surfaces: ASTM A 780, zinc-rich primer.

F. Fasteners:
1. Screws: Self-drilling, self-tapping screws; steel, complying with ASTM C 1002; galvanized coating, plated or oil-phosphate coated complying with ASTM B 633 as needed for required corrosion resistance.
2. Interior Wall and Partition Floor Track Anchorage Device at Concrete Slabs: Low velocity powder-actuated drive pins; minimum 0.140 inch shank diameter x 1-1/2 inch shank length with steel washer.
3. Anchor Bolts for Exterior Walls: ASTM A 307, Grade C.
4. Welding: In conformance with AWS D1.3.

G. Exterior Wall Sill Plate Sealer Strip:
1. Manufacturer: Protecto Wrap.
2. Product: Protecto Premium Energy Sill Sealer.
3. Description: 3/8 inch closed cell polyethylene foam with self adhesive waterproof membrane, air, moisture and insect barrier sill sealer.

2.3 FABRICATION

A. Fabricate panels plumb, square, and true to line.

B. Fabricate assemblies of framed sections of sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.

C. Fit and assemble in largest practical sections for delivery to site, ready for installation.

D. Cut all framing components squarely for attachment to perpendicular members, or as

required for an angular fit against abutting members. Hold members positively in place until properly fastened.

E. Provide insulation as specified elsewhere in all double jamb studs and double header members, which will not be accessible to the insulation contractor.

F. Axially Loaded Studs:
1. Install studs to have full bearing against inside track web (1/16 inches maximum gap) prior to stud and track attachment.
2. Splices in axially loaded studs are not permitted.

G. Fasteners: Fasten components using self-tapping screws or welding.

H. Anchorage to Slab: Anchor floor tracks and runners to concrete with anchor bolts or powder actuated drive pins.

I. Perform lifting of prefabricated panels in manner to prevent damage or distortion. Framing components may be prefabricated into panels prior to erection.

J. Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer.

K. Welding: Welding permitted on 18 gage or heavier material only.
1. Specify welding configuration and size on the Structural Calculation submittal.
2. Qualify welding operators in accordance with Section 6.0 of AWS D.1.3.
3. Touch up all welds with zinc-rich paint in compliance with ASTM A 780.

L. Wire tying of framing components is not permitted.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Refer to Division 1, General Requirements – Execution for additional requirements on the Verification of existing conditions before starting Work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

### 3.2 INSTALLATION

A. Install metal framing systems in accordance with requirements of ASTM C1007 and manufacturer's printed instruction and recommendations.

B. Runner Tracks:
1. Install continuous tracks sized to match studs.
2. Align floor and ceiling tracks accurately to layout at base and tops of studs.
3. Secure in place with anchor bolts or powder actuated fasteners.

4. Provide fasteners at corners and ends of tracks.
5. Provide deflection allowance in stud track, directly below horizontal building framing for non-load bearing framing.

C. Installation of Wall Stud System:
1. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
2. Secure studs to top and bottom runner tracks at both inside and outside flanges.
3. Place studs at spacing indicated on Drawings; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using connection screws per manufacturer's recommendations.
4. Frame both sides of expansion and control joints, with separate studs; do not bridge joint with components of stud system.
5. Erect studs one piece full length; splicing of studs is not permitted.
6. Brace and reinforce to develop full strength to meet design requirements.
7. Construct corners using minimum of three studs; minimum double stud at wall opening, door, and window jambs.
8. Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than two are either shown or recommended by manufacturer.
9. Install runner tracks and jack studs above and below wall openings.
10. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full height studs of wall.
11. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.
12. Secure stud system all around to wall opening frame.
13. Install horizontal stiffeners in stud system, spaced at not more than 4'-6" o.c. Weld at each intersection.
14. Touch-up damaged galvanized surfaces with primer.

D. Installation of Joists.
1. Make provisions for erection stresses. Provide temporary alignment and bracing.
2. Place joists at spacing indicated on Drawings; not more than 2 inches from abutting walls. Connect joists to supports using method indicated on Drawings.
3. Set joists parallel and level, with lateral bracing and bridging.
4. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track.
5. Provide web stiffeners at reaction points.
6. Touch-up field welds and damaged galvanized surfaces with primer.

E. Support of wall hung equipment:
1. Install supplementary framing, blocking, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, heavy trim, furnishings, and similar work requiring attachment to wall or partition. Comply with stud manufacturer's recommendations for supplementary support, considering weight or loading resulting from item supported.

## 3.3 FIELD QUALITY CONTROL

A. Refer to Division 1, General Requirements - Quality Control: Contractor Quality Control Representative shall perform contractor quality control inspections.

1. Inspect metal framing installation, stud type, gage, spacing, fasteners and connections.
2. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
3. Test and Inspection Reports shall be available to Architect upon request.

B. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

END OF SECTION 054100

# SECTION 055000 - METAL FABRICATIONS

## PART 3 - GENERAL

### 3.6 RELATED DOCUMENTS

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

### 3.7 SUMMARY

A. Section Includes:
   1. Steel framing and supports for mechanical and electrical equipment.
   2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   3. Shelf angles.
   4. Metal ladders.

B. Products furnished, but not installed, under this Section:
   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 Sections:
   1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
   2. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

### 3.8 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Aluminum Ladders: Aluminum ladders[, including landings,] shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Structural Performance of Alternating Tread Devices: Alternating tread devices shall withstand the effects of loads and stresses within limits and under conditions specified in ICC's International Building Code.

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

3.9 ACTION SUBMITTALS

A. Product Data: For the following:
1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

3.10 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

B. Mill Certificates: Signed by manufacturers of stainless-steel 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.

3.11 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

3.12 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

3.13 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. 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.

PART 4 - PRODUCTS

4.6 METALS, GENERAL

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.

4.7 FERROUS METALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

F. Steel Plates, Shapes, and Bars: ASTM A36

G. Steel Tubing: Cold-Formed, ASTM A 500; or hot-formed, ASTM A 501, welded or seamless.

H. Structural Steel Sheet: Hot-rolled, ASTM A570; or cold-rolled ASTM A611, Class 1; or grade required for design loading.

I. Zinc-coated (Galvanized) structural steel sheet.
   1. ASTM A 446, or grade required for design loading.
   2. Coating designation, ASTM A 26, G90.

J. Galvanizing, comply with:
   1. ASTM A 153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
   2. ASTM A 123 – 1 Standard Specification for Zinc (Hot-Galvanized) Coating on products fabricated from rolled, pressed or forged steel shapes, plates, bars and strip.
   3. ASTM A 386 – Standard Specification for Zinc Coating (Hot-Dip) on assembled products.

K. Steel Pipe: ASTM A 3, type E or S, Grade B, black finish unless galvanizing is indicated, standard weight.

L. Concrete Inserts:
   1. Treaded or wedge type; galvanized ferrous castings either malleable iron, ASTM A 47, or cast steel, ASTM A 27 or ASTM A148.
   2. Provide bolts, washers and shims as required, hot-dip galvanized.

M. Non-shrink Nonmetallic Grout:
   1. Grout: Premixed non-shrink, non-metallic aggregate type, complying with ASTM C 1107 and capable of developing a minimum compressive strength of 7,500 psi at 28 days when placed at a plastic consistency of 115 percent flow factor.
   2. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

N. Paint:
1. Shop paint structural steel work, except those members or portions of members to be embedded in concrete or mortar, or contact surfaces which are to be welded or high-strength bolted. Paint embedded steel on exposed portions and initial 2" of embedded areas only. Do not paint steel surfaces which are to receive sprayed-on fire proofing.
2. Surface Preparation: Clean steelwork to be painted complying with SSPC SP 3. Remove oil, grease and similar contaminants, complying with SSPC SP-1.
3. Application: Immediately after surface preparation, apply one coat of structural steel primer paint according to manufacturer's instructions to provide a uniform dry film thickness of 2.5 mils. Provide full covering on joints, corners, edges and all exposed surfaces.

## 4.8 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.
3. Provide stainless-steel fasteners for fastening nickel silver.
4. Provide bronze fasteners for fastening bronze.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Eyebolts: ASTM A 489.

E. Machine Screws: ASME B18.6.3.

F. Lag Screws: ASME B18.2.1.

G. Wood Screws: Flat head, ASME B18.6.1.

H. Plain Washers: Round, ASME B18.22.1.

I. Lock Washers: Helical, spring type, ASME B18.21.1.

J. Anchors, General: Anchors 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 according to ASTM E 488, conducted by a qualified independent testing agency.

K. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

## 4.9 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

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. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

H. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

4.10 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 will be 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.
   1. 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.

## 4.11 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. Galvanize miscellaneous framing and supports where indicated.

## 4.12 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

## 4.13 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3 unless otherwise indicated.
   2. For elevator pit ladders, comply with ASME A17.1.

B. Steel Ladders:
   1. Space siderails 18 inches apart unless otherwise indicated.
   2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
   3. Rungs: 3/4-inch- steel bars.
   4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
   5. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
   6. Prime ladders, including brackets and fasteners, with red oxide primer.

## 4.14 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 plates.

C. Prime plates with zinc-rich primer.

## 4.15 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 loose steel lintels located in exterior walls.

## 4.16 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.

## 4.17 FABRICATION

A. Use materials of size and thickness indicated or as required to produce strength and durability in finished product for use intended. Work to dimensions indicated using proven details of fabrication and support. Use type of materials indicated or specified for various components of work.

B. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to radius of approximately 1/32". Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

E. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of Phillips flathead countersunk type screws or bolts.

F. Provide for anchorage of type indicated, coordinated with supporting structure Fabricate and space anchoring devices to provide adequate support for intended use.

G. Cut, reinforce, drill, and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

H. Galvanizing: Provide zinc coating for items indicated or specified to be galvanized.

I. Fabricate joints which will be exposed to weather to exclude water or provide weep holes where water may accumulate.

4.18 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

4.19 FABRICTION COMPONENTS

A. Rough Hardware:

1. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures.
2. Fabricate items to sizes, shapes and dimensions required.
3. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

B. Loose Bearing and Leveling Plates:
1. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area.
2. Drill plates to receive anchor bolts and for grouting as required.
3. Prime paint after fabrication.

C. Loose Steel Lintels:
1. Provide loose structural steel lintels for openings and recesses in masonry walls and partitions shown.
2. Weld adjoining members together to form single unit where required.
3. Provide not less than 8" bearing at each side of opening.
4. Galvanize loose steel lintels to be installed in exterior walls.

D. Miscellaneous Framing and Supports:
1. Provide miscellaneous steel framing and supports which are not part of structural steel framework, required to complete work.
2. Fabricate miscellaneous units to sizes, shapes and profiles indicated or of required dimensions to receive work of related Sections.
3. Fabricate from structural steel shapes, plates, and steel bars, of welded construction using mitered joints for field connection.
4. Cut, drill, and tap units to receive hardware and similar items.
5. Equip units with integrally welded anchors for casting into concrete or building into masonry.
6. Galvanize exterior miscellaneous frames and supports.

E. Miscellaneous Steel Trim:
1. Provide shapes and sizes for profiles shown.
2. Fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges.
3. Use concealed field splices wherever possible.

4. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.
5. Galvanize exterior miscellaneous steel trim.

F. Shelf Angles:
1. Provide structural steel shelf angles of sizes indicated for attachment to concrete framing.
2. Provide slotted holes to receive 3/4" bolts, spaced not more than 4" from ends and not more than 16" o.c.
3. Galvanize shelf angles to be installed on exterior concrete framing.

G. Bollards:
1. 6" diameter x 6'-6" galvanized pipe with 0.322" minimum thick wall, for setting 3'-0" below grade.
2. Fill with concrete and form dome top.

H. Ladders:
1. Fabricate ladders for locations shown, with dimensions spacings, details and anchorages as indicated.
2. Comply with requirements of ANSI A14.3.
3. Fit rungs at centerline of side rails, plug weld, and grind smooth on outer rail faces.
4. Support each ladder at top and bottom and at intermediate points spaced not more than 5'-0" o.c.
5. Use welded or bolted steel brackets, designed for adequate support and anchorage, and to hold the ladder clear of wall surface as required.
6. Extend rails 42" above top rung, and return rails to wall or structure as required.
7. Provide non-slip surface on top of each rung, either by coating rung with aluminum oxide granules set in epoxy resin adhesive, or by using type of manufactured rung which is filled with aluminum oxide grout.

## PART 5 - EXECUTION

### 5.6 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.

5.7 INSTALLING 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 grout.
1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLATION GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous fabrications to in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement:
1. Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications.
2. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
3. Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry or similar construction.
4. Fit exposed connections accurately together to form tight, lightproof joints.

C. Field Welding:
1. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations.
2. Grind exposed joints smooth and touch-up shop paint coat.
3. Do not weld, cut, or abrade surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

D. Setting Loose Plates:
1. Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces.
2. Clean bottom surface of bearing plates.
3. Set loose leveling and bearing plates on wedges, or other adjustable devices.
4. After bearing members have been positioned and plumbed, tighten anchor bolts.
5. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
6. Use nonmetallic, non-shrink grout.
7. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 FIELD PAINTING

A. General:
1. Clean spots and surfaces where primer coats have been removed, damaged, or burned off, and clean field bolts and other field connections not concealed in finished Work.
2. Remove dirt, oil, and grease.

3. Apply a coat of specified paint.
4. Do not apply paint to wet, damp, oily, or improperly prepared surfaces.

B. Notify Architect when the work of this Section is ready to receive field painting.
1. Secure review by Architect prior to field painting.
2. Using spray or brush, as recommended by manufacturer of specified paint material, fill all joints and corners and cover the surfaces with a smooth unbroken wet film sufficient to provide a dry film thickness of x 2.5 mil.

**3.5** FIELD QUALITY CONTROL

C. Erection Inspecting:
1. The Owner's Testing and Inspecting Agency will inspect bolted connections, shop and field welded connections, vertical and horizontal alignment and perform additional tests and re-inspections of work as are required by Owner, and will prepare test reports for the Owner's review.
2. The testing agency will conduct and interpret tests, and will state in each report whether inspected work complies with the requirements, specifically stating all deviations.

D. Correct deficiencies in products and installation found not to be in compliance with Contract Documents.

3.6 ADJUSTING AND CLEANING

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

F. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in with same material as primer.

G. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000


AIA HPA
ARCHITECTS PROGRAMMERS PLANNERS

# SECTION 055200 ALUMINUM HANDRAILS AND RAILINGS

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. The work specified in this Section includes, but shall not be limited to, the following:

1. Aluminum handrails.
2. Aluminum railings.

B. Related Sections:

1. Section 05 70 00 - Ornamental Metal: Adjacent or adjoining handrails and railings fabricated from steel pipe and tube components.

### 1.2 REFERENCES

A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

B. Aluminum Association, Inc. (AA):
1. AA SAS-30, "Specifications for Aluminum Structures."

C. American Architectural Manufacturers Association (AAMA):
1. AAMA 611, "Voluntary Specifications for Anodized Architectural Aluminum (Revised)."
2. AAMA 2604, "Voluntary Specification, Performance Requirements, and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels."
3. AAMA 2605, "Voluntary Specification, Performance Requirements, and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels."

D. American Iron and Steel Institute (AISI):
1. AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."

E. American Welding Society (AWS):
1. AWS D1.2, "Structural Welding Code – Aluminum."

F. ASTM (ASTM):
1. ASTM B26/B26M,"Standard Specification for Aluminum-Alloy Sand Castings."
2. ASTM B209/B209M,"Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate."
3. ASTM B210/B210M, "Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes."
4. ASTM B221/B221M, "Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes."
5. ASTM B247/B247M, "Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings."
6. ASTM B429/B429M, "Standard Specification for Aluminum-Alloy Extruded Structural Pipe

and Tube."
7. ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic Cement Grout (Non-Shrink)."
8. ASTM E488, "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements."
9. ASTM E985, "Standard Specification for Permanent Metal Railing Systems and Rails for Buildings."

G. National Association of Architectural Metal Manufactures (NAAMM):
1. NAAMM MFM, "Metal Finishes Manual.

1.3 DEFINITIONS

A. See definitions in ASTM E985 for railing-related terms that apply to this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General: Handrails and railings shall withstand structural loading as determined by allowable design working stresses of materials based on the following standards.
1. Aluminum: AA SAS-30.
2. Cold-Formed Structural Steel: AISI SG-673, Part I.

B. Structural Performance: Provide handrails
C. and railings capable of withstanding the following structural loads without exceeding allowable design working stress of materials for handrails, railings, anchors, and connections:
1. Top Rail: Shall withstand the following loads:
a. Concentrated load of 200 lbf (0.89 kN) applied at any point and in any direction.
b. Uniform load of 50 lbf-ft. (0.07 kN-m) applied horizontally and concurrently with uniform load of 100 lbf-ft. (0.14 kN-m) applied vertically downward.
c. Concentrated and uniform loads above need not be assumed to act concurrently.
2. Handrails Not Serving As Top Rails: Shall withstanding the following loads:
a. Concentrated load of 200 lbf (0.89 kN) applied at any point and in any direction.
b. Uniform load of 50 lbf-ft. (0.07 kN-m) applied in any direction.
c. Concentrated and uniform loads above need not be assumed to act concurrently.

3. Guard Infill Area: Shall withstand the following loads:
a. Concentrated horizontal load of 200 lbf (0.89 kN) applied to 1 square foot (0.09 $m^2$) at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area. Loads need not be assumed to act concurrently with loads on top rails in determining stress on guard.

D. Thermal Movements: Handrails and railings shall allow for movements resulting from 120 deg F (49 deg C) changes in ambient and 180 deg F (82 deg C) surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

E. Corrosion Resistance: Separate incompatible materials to prevent galvanic corrosion.

1.5 SUBMITTALS

A. General: Submit under provisions of Section 01 33 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including, but not limited to, the following:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Product Data: Submit product data for manufacturers product lines of handrails and railings assembled from standard components, including, but not limited to, the following:
1. Grout, anchoring cements and paint products.

D. Shop Drawings: Submit shop drawings showing fabrication and installation of handrails and railings. Include plans, elevations, sections, details, and attachments to other work.

E. Samples:
1. Color Selection: Submit manufacturer's color charts showing the full range of colors available for products with factory-applied color finishes.
2. Finish Selection: Provide sections of railing or flat sheet metal which depict available mechanical surface finishes.
3. Verification Samples: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
   a. 6 inch (152 mm) long sections of each different linear railing member, including handrails and top rails.

F. Quality Control Submittals:
1. Design Data: For installed handrails and railing systems indicated to comply with certain design loadings, include structural analysis data signed and sealed by the professional engineer who was responsible for their preparation.
2. Certificates: Submit certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's).

1.6 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of aluminum handrails and railings of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 10 years.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.

C. Welding Standards: Comply with applicable provisions of AWS D1.2.

D. Supply sample submittals to demonstrate aesthetic effects as well as qualities of materials and execution.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PROJECT CONDITIONS

A. Environmental Requirements: Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

A. General: See Section 01 77 00 - Closeout Procedures.

B. Special Warranty: Provide manufacturer's standard form outlining the terms and conditions of their standard Limited Warranty:
   1. Surface Finish Warranty: Five year limited warranty.
   2. Material Integrity Warranty: One year.

C. Additional Owner Rights: The warranty 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.

1.10 EXTRA MATERIALS

A. All supplemental materials not expressly specified in this section shall be approved by the Architect prior to installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other manufacturers are acceptable. The Architect will be the sole judge of the basis of what is equivalent.

2.2 MATERIALS

A. Application/Scope of Work:

   1. Architectural railing.

B. Basis of Design: C.R. Laurence Co., Inc. (CRL)
   Tel: (800) 421-6144 Fax: (800) 587-
   Email: railings@crlaurence.com
   www.crlaurence.com

C. Metals: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.
   1. Aluminum: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of alloy and temper designated below for each aluminum form required.
      a. Extruded Bar and Tube: ASTM B221/B221M, Alloy 6063-T5/T52.
      b. Extruded Structural Pipe and Tube: ASTM B429/B429M, Alloy 6063-T832.
      c. Drawn Seamless Tube: ASTM B210/B210M, Alloy 6063-T832.
      d. Plate and Sheet: ASTM B209/B209M, Alloy 6061-T6.
      e. Die and Hand Forgings: ASTM B247/B247M, Alloy 6061-T6.
      f. Castings: ASTM B26/B26M, Alloy A356-T6.

2. Brackets, Flanges, and Anchors: Provide cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
   a. Provide cast brackets with flange tapped for concealed anchorage to threaded hanger bolt.
   b. Provide formed or cast brackets with predrilled hole for exposed bolt anchorage.
   c. Provide formed steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.
   d. Provide brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.

D. Railing Components:
1. Extruded Aluminum Components: Provide manufacturer's standard extruded aluminum components as follows:
   a. Standard Post: 2.376 inches by 2.376 inches with radiused corner, 0.100 inch wall thickness.
   b. Bottom Rail: 1.6926 inches high by 1.676 inches high with a 0.765 inch wide pocket on the top and an open bottom.
   c. Picket: 0.750 inches by 0.750 inches, 0.062 inch wall thickness.
   d. Top Rail: Circular cross section, radius as indicated on the Drawings or, if not indicated, as selected by the Architect from the manufacturer's standards with an open bottom, 0.0866 inch wall thickness.

E. Fasteners:
1. Handrail Anchors: Select fasteners of type, grade and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.
2. Handrail and Railing Component Anchors: Use fasteners fabricated from same basic metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
   a. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are standard fastening method for handrail and railing indicated.
   b. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
3. Cast-in-Place and Post Installed Anchors: Provide anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four items the load imposed when installed in concrete, as determined by testing per ASTM E488 conducted by a qualified independent testing agency.

   a. Cast-in-place anchors.
   b. Chemical anchors.
   c. Expansion anchors.

F. Grout and Anchoring Cement:
1. Non-Shrink, Non-Metallic Grout: Provide premixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
2. Interior Anchoring Cement: Provide factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at project site to
create pourable anchoring, patching and grouting compound. Use for interior applications only.

2.3 FABRICATION

A. Assemble handrails and railings in shop to greatest extent possible to minimize filed splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

B. Form changes in direction of railing members as shown on the Drawings.

C. Fabricate handrails and railings by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

D. Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.

E. Provide inserts and other anchorage devices to connect handrails and railings to concrete or masonry. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

F. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

G. Cut, reinforce, drill, and tap components as indicated on the Drawings to receive finish hardware, screws, and similar items.

H. Close exposed ends of railing members with prefabricated end fittings.

I. Provide mounted handrail wall returns at wall ends unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch (6 mm) or less.

2.4 FINISHES

A. General: Comply with NAAMM MFM for recommendations for applying and designating finishes.
   1. Appearance of Finished Work:
      a. Variations in appearance of abutting or adjacent units are acceptable if they are within one-half of the range of final samples. Noticeable variations in the same unit are not acceptable.
      b. Variations in appearance of other components are acceptable if they are within the range of final samples and are assembled or installed to minimize contrast.

B. Aluminum Finish: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

   1. Class I Color or Clear Anodized Finish: AA-M21-C22-A42/A44 Mechanical Finish: as fabricated, non-specular; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, film thicker than 0.7 mil [0.018 mm] with integral color or electrolytically deposited color complying with AAMA 611. Provide color to match the Architect’s sample, or, if no sample, as selected by the Architect from within full range of industry colors and color density range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
   1. Examine substrates to receive anchors verifying that locations of concealed reinforcements have been clearly marked for the Installer. Locate reinforcements and mark locations if not already done.
   2. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

### 3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchors, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the Project site.

### 3.3 INSTALLATION

A. General:
   1. Fitting: Fit exposed connections together to form tight, hairline joints.
   2. Cutting and Placement: Set handrails and railings accurately in location, alignment, and elevation measured from established lines and levels and free from rack.
      a. Do not weld, cut, or abrade coated or finished surfaces of railing components that are intended for field connection by mechanical or other means without further cutting or fitting.
      b. Align rails so variations from level or parallel alignment do not exceed 1/4 inch in 12 feet.
      c. Provide manufacturer’s proprietary system to evacuate entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources, in order to prevent water from entering the concrete slab. In lieu of the manufacturer’s proprietary system, if acceptable to the Architect, provide another means to evacuate the entrapped water, i.e., a weephole and epoxy fill system (“drill-and-fill”).
      d. Anchor posts in concrete with pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, solidly fill annular space between post and sleeve with non-metallic, non-shrink grout, mixed and placed to comply with anchoring material manufacturer's directions.
      e. Anchor posts in concrete by forming or core drilling holes not less than 5 inches deep and 3/4 inch greater than outside diameter of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-metallic, non-shrink grout, mixed and placed to comply with anchoring material manufacturer's directions.

         1) Cover anchorage joint with a round steel flange attached to post by welding to post after placement of anchoring material.
         2) Cover anchorage joint with a round steel flange attached to post by set screws.
         3) Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8 inch buildup, sloped away from post.

3. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
4. Adjusting: Adjust handrails and railings before anchoring to ensure alignment at abutting joint's space posts at interval indicated, but not less than required to achieve structural loads.
5. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

B. Non-Welded Railings Connections: Use mechanical joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings.

3.4 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and appoint exposed areas with same material.

B. Cleaning: Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to the Installer that shall ensure that the aluminum handrails and railings shall be without damage at time of Substantial Completion.

B. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.

END OF SECTION 055200

# SECTION 058100 - EXPANSION JOINT COVER ASSEMBLIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

B. Reference Architectural Floor Plan Key Notes.

### 1.2 SUMMARY

A. This Section includes the following:

1. Floor-To-Floor expansion joint cover assemblies.
2. Wall-To-Floor joint cover assemblies.
3. Wall-To-Wall joint cover assemblies.

### 1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of expansion joint cover assembly specified, including manufacturer's product specifications, installation instructions, details of construction relative to materials, dimensions of individual components, profiles, and finishes.

C. Shop drawings showing fabrication and installation of expansion joint cover assembly including plans, elevations, sections, details of components, joints, splices, and attachments to other units of Work.

### 1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain expansion joint cover assemblies specified in this Section from one source from a single manufacturer. Coordinate compatibility with expansion joint cover assemblies specified in other sections.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the products specified in each Expansion Joint Cover Assemblies Product Data Sheet at end of this Section.

### 2.2 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), alloy 6061-T6, sheet and plate.

1. Protect aluminum surfaces to be placed in contact with cementitious materials with a protective coating.

B. Accessories: Manufacturer's standard anchors, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesive, and other accessories compatible with material in contact, as indicated or required for complete installations.

## 2.3 EXPANSION JOINT COVER ASSEMBLIES

A. General: Provide expansion joint cover assemblies of design, basic profile, materials, and operation indicated. Provide units comparable to those indicated or required to accommodate joint size, variations in adjacent surfaces, and dynamic structural movement without material degradation or fatigue when tested according to ASTM E 1399. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint cover assemblies.

B. Metal Floor-to-Floor and wall to wall Joint Cover Assemblies: Provide continuous extruded metal frames of profile indicated with seating surface and raised floor rim or exposed trim strip to accommodate flooring and concealed bolt and anchors embedded in concrete. Provide assemblies formed to receive cover plates of design indicated and to receive filler materials (if any) between raised rim of frame and edge of plate. Furnish depth and configuration to suit type of construction and to produce a continuous flush wearing surface with adjoining finish floor surface.

1. Flat Cover Plates: Provide cover plates of profile indicated. Extend flat plates to lap each side of joint.

2. Floor Cover Plate Wearing Surfaces: Provide cover plates with the following type of wearing surfaces.

a. Plain.

## 2.4 METAL FINISHES

A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes to products in factory after fabrication. Protect finishes on exposed surfaces before shipment.

B. Aluminum Finishes: Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

1. Mill Finish: AA-M10 (unspecified mill finish).

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Manufacturer's Instructions: In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for phases of Work, including preparing substrate, applying materials, and protecting installed units.

B. Coordinate and furnish anchorages, setting drawings, templates, and instructions for installation of expansion joint cover assemblies to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure expansion joint cover assemblies to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.

## 3.2 INSTALLATION

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install expansion joint covers. Install joint cover assemblies in true alignment and proper relationship to expansion joints and adjoining finished surfaces measured from established lines and levels. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling. Set floor covers at elevations to be flush with adjacent finished floor materials. Locate wall, ceiling, roof, and soffit covers in continuous contact with adjacent surfaces. Securely attach in place with required accessories. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) on center.

B. Continuity: Maintain continuity of expansion joint cover assemblies with a minimum number of end joints and align metal members mechanically using splice joints. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials (if any) to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

## 3.3 CLEANING AND PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's instructions.

## PRODUCT DATA SHEET 1 - EXPANSION JOINT COVER ASSEMBLIES

A. Floor-to-Floor Joints: Balco type GF-1P, GF-2P – width as required
B. Wall-to-Floor Joints: Balco type GC-2
C. Wall-to-Wall Joints: Balco GC-1

END OF SECTION 058100


AIA HPA
ARCHITECTS PROGRAMMERS PLANNERS

# SECTION 061000 - ROUGH CARPENTRY

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with timber.
3. Framing with engineered wood products.
4. Shear wall panels.
5. Rooftop equipment bases and support curbs.
6. Wood blocking nailers.
7. Wood furring.
8. Wood sleepers.
9. Utility shelving.
10. Plywood backing panels.

B. Related Requirements:

1. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

### 1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. 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 D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

## 1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.

## 1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

## 1.7 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.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent.

C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

## 2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.

D. 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, stripping, 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 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.
7. Utility shelving.
8. Wall Door Stops.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods; No. 2 Common grade; NeLMA.
5. Northern species; No. 2 Common grade; NLGA.
6. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

1. Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

## 2.6 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

# PART 3 - EXECUTION

## 3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

E. Shear Wall Panels: Install shear wall panels to comply with manufacturer's written instructions.

F. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

H. Do not splice structural members between supports unless otherwise indicated.

I. 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.

J. Sort and select lumber so that natural characteristics will 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.

K. 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.

L. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

M. 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.

N. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

## 3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

## 3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring vertically at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

## 3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather.

END OF SECTION 061000


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# SECTION 061600 - SHEATHING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.

### 1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

### 1.4 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 WALL SHEATHING

A. Polyisocyanurate-Foam Wall Sheathing with coated fibrous facer on both sides: ASTM C 1289, rigid, cellular, polyisocyanurate thermal insulation. Foam-plastic core and facings shall have a flame-spread index of 25 or less when tested individually.

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. Atlas Roofing Corporation – Energy Shield
   b. Dow Chemical Company (The).
   c. Rmax, Inc.

2. Thickness: 5/8 inch.
3. R-Value: 3.8 minimum.

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M of Type 304 stainless steel.

B. Screws for Fastening Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.
3. Do Not penetrate sheathing with screw heads.

2.3 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sheathing Tape for Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

1. Tape all joints with Alas WRB flashing tape.

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. Securely attach by screwing panels at 8” o.c. at edges and center supports.

D. 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 FOAM-PLASTIC SHEATHING INSTALLATION

A. Comply with manufacturer's written instructions.

B. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

END OF SECTION 061600

# SECTION 064020 - INTERIOR ARCHITECTURAL WOODWORK

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Laminate-clad cabinets (plastic-covered casework) – Euro Style cabinets
2. Solid surface cabinet tops .
3. Stained wood cabinetry.

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

1. Division 6 Section "Rough Carpentry" for exposed framing and for furring, blocking, and other carpentry work concealed in the wall.
2. Division 6 Section "Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.
3. Division 9 Section "Painting" for field finishing of installed interior architectural woodwork.

### 1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction prior to woodwork installation.

### 1.4 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 each type of product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

C. Fire-retardant-treatment data for material treated to reduce combustibility. Include certification by treating plant that treated materials comply with requirements.

D. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcing specified in other Sections.

3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.

E. Samples for the following in the form of manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.

1. Shop-applied transparent finishes.
2. Plastic laminates.

F. Product certificates signed by woodwork fabricator certifying that products comply with specified requirements.

## 1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.

B. Single-Source Responsibility for Fabrication and Installation: Engage a qualified woodworking firm to assume undivided responsibility for fabricating and installing woodwork specified in this Section.

C. Quality Standard: Except as otherwise indicated, comply with the following standard:

1. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grades of interior architectural woodwork, construction, finishes, and other requirements.

D. Fire-Test-Response Characteristics: Provide materials with the following fire-test-response characteristics as determined by testing identical products per ASTM test method indicated below by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify fire-retardant-treated material with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1. Surface-Burning Characteristics: Not exceeding values indicated below, tested per ASTM E 84 for 30 minutes with no evidence of significant combustion. In addition, the flame front shall not progress more than 10-1/2 feet (3.2 m) beyond the center line of the burner at any time during the test.

a. Flame Spread: 25.
b. Smoke Developed: 450.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

B. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.
2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.8 COORDINATION

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

B. Hardware Coordination: Distribute copies of approved schedule for cabinet hardware specified in Division 8 Section "Door Hardware" to fabricator of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of the WIC quality standard for each type of woodwork and quality grade indicated, unless otherwise indicated.

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2.
3. Softwood Plywood: PS 1.
4. Hardwood Plywood and Face Veneers: HPVA HP-1.

B. Fiberboard: Medium-density fiberboard made without formaldehyde and complying with ANSI A208.2.

1. Product: Subject to compliance with requirements, provide Medite II by Medite Corp.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.

1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:

a. Formica Corporation.
b. Nevamar Corp.
c. Wilsonart International

D. Adhesive for Bonding Plastic Laminate: Contact cement.

E. Thermoset Decorative Overlay: Decorative surface of thermally fused polyester or melamine-impregnated web, bonded to specified substrate and complying with ALA 1992.

1. Substrate: Medium-density fiberboard.

## 2.2 CABINET HARDWARE AND ACCESSORY MATERIALS

A. Cabinet Hardware Schedule: Refer to schedule at end of this Section for cabinet hardware required for architectural cabinets.

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by reference to BHMA numbers or referenced to this standard.

C. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA code number indicated.

1. Brushed Aluminum - 626.

## 2.3 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1 for applicable requirements.

1. For metal framing supports, provide screws as recommended by metal-framing manufacturer.

C. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

D. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

## 2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Provide interior woodwork complying with the referenced quality standard and of the following grade:

1. Grade: Custom.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to relative humidity conditions existing during time of fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of cabinets and edges of solid-wood (lumber) members 3/4 inch (19 mm) thick or less: 1/16 inch (1.5 mm).
2. Edges of rails and similar members more than 3/4 inch (19 mm) thick: 1/8 inch (3 mm).
3. Corners of cabinets and edges of solid-wood (lumber) members and rails: 1/16 inch (1.5 mm).

D. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at the fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on approved shop drawings before disassembling for shipment.

E. Shop-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.

## 2.5 LAMINATE-CLAD CABINETS (PLASTIC-COVERED CASEWORK)

A. Quality Standard: Comply with AWI Section 400.

1. Grade: Custom.

B. AWI Type of Cabinet Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other than Tops: GP-50, 0.050-inch (1.270-mm) nominal thickness.
2. Vertical Surfaces: GP-50, 0.050-inch (1.270-mm) nominal thickness.
3. Edges: GP-50, 0.050-inch (1.270-mm) nominal thickness – Premolded grooved insert – Edges will not be accepted.

D. Materials for Semiexposed and Not Exposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other than Drawer Bodies: Thermoset decorative overlay (Melomine).
2. Drawer Bottoms: Thermoset decorative overlay (Melomine).

E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Melomine: Colors: White, Beige, Gray, Tan, Black; to be selected by the Owner/Architect.

2 Provide Architect's selections from laminate manufacturer's full range of colors and finishes in the following categories: Architect may select a variety of color combinations from full range of colors.

a. Solid colors.
b. Wood grains.
c. Patterns.

2.6 SHELVES

A. Provide ¾" x 1 ½" shelf edge reinforcement banded and finished same as face of shelves and paint to match hardware and plywood shelf on all adjustable shelves, front and back, and cover with plastic laminate where shelves are to be plastic laminant covered.

2.7 COUNTERTOPS

A. Quality Standard: Comply with applicable AWI section indicated below:

1. Grade: Custom.

B. Type of Top: Solid Surface:

1. Acrylic resin, with fire retardant fillers and coloring agents that are homogenous with uniform color throughout the thickness. Type 05L
2. Matt or High Gloss
3. Thickness: 050"
4. Equal to Wilsonart Earthstone; Gibraltar , Price Group 1-5
5. ASTM G-22; ASTM G-21; Bacterial, fungal resistant
6. Edge Detail – as selected by Owner/Architect from full range of styles.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

A. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm)

B. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

C. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

D. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where necessary. Stagger joints in adjacent and related members. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.

1. Install standing and running trim with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) variation from a straight line.

E. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.

F. Tops: Anchor securely to base units and other support systems as indicated. Calk space between backsplash and wall with specified sealant.

1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c.

## 3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

## 3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

## 3.5 CABINET HARDWARE AND ACCESSORY SCHEDULE

A. Concealed (European Type) Hinges: Grass 3000 series, 120 degree opening, 626 finish.

B. Pulls: Wire pulls, 4 inches (100 mm) long, 5/16 inches (8 mm) in diameter Stanley No. 4484-626 finish.

C. Catches: As follows:

1. Magnetic Catches: SP-41, Stanley.

D. Adjustable Shelf Standards: No. 255, Knape and Vogot.

1. Shelf Rests for Standards: No. 256, Knape and Vogot.

E. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings.

1. Box Drawer Slides: Knape and Vogot No. 8805 for all drawers up to 18” wide. Load rated at 200 pounds.
2. Box Drawer Slides: Knape and Vogot No. 8500T for larger drawers over 18” wide. Load rating 150 pounds.
3. Lateral File Drawer Slides: Knape & Vogot no. 8520, load rated for 175 pounds.

F. Butt Hindge: Stanley No. 1589 for wardrobe door.

END OF SECTION 064020

# SECTION 064040 – SOLID SURFACE WINDOW SILLS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Solid Surface Window Sills.

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

1. Division 6 Section "Rough Carpentry" for exposed framing and for furring, blocking, and other carpentry work concealed in the wall.
2. Division 6 Section "Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.

### 1.3 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 each type of product and process specified and incorporated into items of architectural solid surface during fabrication, finishing, and installation.

C. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcing specified in other Sections.

D. Samples for the following in the form of manufacturer's actual samples showing the full range of colors, textures, and patterns available.

1. Solid Surface Materials.

### 1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing architectural solid surface similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

B. Do not deliver solid surface until painting and similar operations that could damage, soil, or deteriorate surface have been completed in installation areas. If solid surface must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install solid surface until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where solid surface is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 SOLID SURFACE WINDOW SILLS

A. Acrylic resin, with fire retardant fillers and coloring agents that are homogenous with uniform color throughout the thickness.

B. Matt or High Gloss

C. Thickness: .490"

D. Equal to Wilsonart Earthstone

E. ASTM G-22; ASTM G-21; Bacterial, fungal resistant

2.13 SOLID SURFACE ACCESSORIES

A. Joint adhesive:

1. Manufacturer’s standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.

B. Sealant:

1. Manufacturer’s standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.

C. Conductive tape:

1. Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.

E. Insulating felt tape:

1. Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install solid surface plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm)

B. Scribe and cut solid surface to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

C. Anchor solid surface to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with concealed fasteners.

D. Tops: Anchor securely to base units and other support systems as indicated. Calk space between backsplash and wall with specified sealant.

1. Install sills with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective work where possible to eliminate functional and visual defects; where not possible to repair, replace solid surface. Adjust joinery for uniform appearance.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that solid surface is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 064040


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# SECTION 071900 - 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 penetrating water-repellent treatments for the following vertical and horizontal surfaces:

1. Cast stone.
2. Clay brick masonry.

### 1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Water repellents shall meet performance requirements indicated without failure due to defective manufacture, fabrication, or installation.

B. Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours in comparison of treated and untreated specimens.

1. Cast Stone: ASTM C 1195.
2. Clay Brick: ASTM C 67.

C. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, according to ASTM E 514.

### 1.4 ACTION SUBMITTALS

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

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.
3. 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.

### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Applicator.

B. Product Certificates: For each type of water repellent, from manufacturer.

C. Preconstruction Testing Reports: For water-repellent-treated substrates.

D. Field quality-control reports.

E. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

B. MPI Standards: Comply with MPI standards indicated and provide water repellents listed in its "MPI Approved Products List."

1.7 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. Building has been closed in for not less than 30 days before treating wall assemblies.
2. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
3. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
4. Rain or snow is not predicted within 24 hours.
5. Not less than seven days have passed since surfaces were last wet.
6. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer] agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

A. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 400 g/L or less of VOCs.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Prime-A-Pell H20.

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 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.

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. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using 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.

B. 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. Owner will 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 071900

# SECTION 072100 - THERMAL INSULATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.

B. Related Sections:

1. Section 061600 "Sheathing" for sheathing over wood or steel framing.

### 1.3 ACTION SUBMITTALS

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

### 1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

### 1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

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 Corporation.
2. Johns Manville.
3. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Kraft-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

D. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation:

3.4 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.5 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.6 INSULATION SCHEDULE

A. Stud Wall Insulation: Width to fill stud space. If exact depth is not available, use next larger thickness.

1. 8” for 8” studs – R Value of 25.
2. 4” for 3 - 5/8” and 4” studs – R Value of 15.
3. 3 ½” for insulation above lay-in ceilings – R Value 11.

END OF SECTION 072100


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# SECTION 072400 – EXTERIOR INSULATION AND FINISH SYSTEM CLASS PB

## PART I – GENERAL

### 1.1 SUMMARY

A. This document is to be used in preparing specifications for projects utilizing the Dryvit Outsulation Plus System. For complete product description and usage refer to:

1. Dryvit Outsulation Plus Data Sheet, DS445.
2. Dryvit Outsulation Plus System Application Instructions, DS218.
3. Dryvit Outsulation Plus System Installation Details, DS110.

B. Related Sections

1. Unit Masonry – Section 04200
2. Concrete – Sections 03300 and 03400
3. Light Gauge Cold Formed Steel Framing – Section 05400
4. Wood Framing – Section 06100
5. Sealant – Section 07900
6. Flashing – Section 07600

### 1.2 REFERENCES

A. Section Includes

1. ASTM B 117 (Federal Test Standard 141A Method 6061) Standard Practice for Operating Salt Spray (Fog) Apparatus
2. ASTM C 150 Standard Specification for Portland Cement
3. ASTM C 297 Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions
4. ASTM C 1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
5. ASTM C 1396 (formerly C 79) Standard Specification for Gypsum Board
6. ASTM D 968 (Federal Test Standard 141A Method 6191) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
7. ASTM D 2247 (Federal Test Standard 141A Method 6201) Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
8. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
9. ASTM D 4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
10. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
11. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials
12. ASTM E 119 Standard Method for Fire Tests of Building Construction and Materials
13. ASTM E 283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
14. ASTM E 330 Test Method for Structural Performance of Exterior Windows, Doors and Curtain Walls by Uniform Static Air Pressure Difference
15. ASTM E 331 Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference

16. ASTM E 2098 Test Method for Determining the Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to Sodium Hydroxide Solution.
17. ASTM E 2134 Test Method for Evaluating the Tensile-Adhesion Performance of Exterior
18. ASTM E 2273 Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies.
19. ASTM E 2430 Standard Specification for Expanded Polystyrene (EPS) Thermal Insulation Boards for use in Exterior Insulation and Finish Systems (EIFS)
20. ASTM E 2485 (formerly EIMA Std. 101.01) Standard Test Method for Freeze-Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water-Resistive Barrier Coatings
21. ASTM E 2486 (formerly EIMA Std. 101.86) Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)
22. ASTM G 155 (Federal Test Standard 141A Method 6151) Standard Practice for Operating-Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials
23. DS131, Dryvit Expanded Polystyrene Insulation Board Specification
24. DS151, Custom Brick™ Polymer System Specifications for Use On Vertical Walls
25. DS152, Dryvit Cleaning and Recoating
26. DS153, Dryvit Expansion Joints and Sealants
27. DS159, Dryvit Water Vapor Transmission
28. DS456, Rapidry DM™ 35-50 or DS457, Rapidry DM™ 50-75 Data Sheets
29. DS494, Dryvit AquaFlash™ System
30. Mil Std E5272 Environmental Testing
31. Mil Std 810B Environmental Test Methods
32. NFPA 268 Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
33. NFPA 285 Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus
34. ANSI FM 4880 Evaluating Insulated Wall or Wall and Roof/Ceiling Assemblies; Plastic Interior Finish Materials; Plastic Exterior Building Panels; Wall/Ceiling Coating Systems; Interior or Exterior Finish Systems

## 1.3 DEFINITIONS

A. Base Coat: Material used to encapsulate one or more layers of reinforcing mesh fully embedded that is applied to the outside surface of the EPS.

B. Building Expansion Joint: A joint through the entire building structure designed to accommodate structural movement.

C. Contractor: The contractor that installs the Outsulation Plus System to the substrate.

D. Dryvit: Dryvit Systems, Inc., the manufacturer of the Outsulation Plus System, a Rhode Island corporation.

E. Expansion Joint: A structural discontinuity in the Outsulation Plus System.

F. Finish: An acrylic-based coating, available in a variety of textures and colors that is applied over the base coat.

G. Insulation Board: Expanded polystyrene (EPS) insulation board, which is affixed to the substrate.

H. Panel Erector: The contractor who installs the panelized Outsulation Plus System.

I. Panel Fabricator: The contractor who fabricates the panelized Outsulation Plus System.

J. Reinforcing Mesh: Glass fiber mesh(es) used to reinforce the base coat and to provide impact resistance.

K. Sheathing: A substrate in sheet form.

L. Substrate: The material to which the Outsulation Plus System is affixed.

M. Substrate System: The total wall assembly including the attached substrate to which the Outsulation Plus System is affixed.

1.4 SYSTEM DESCRIPTION

A. General: The Dryvit Outsulation Plus System is an Exterior Insulation and Finish System (EIFS), Class PB, consisting of a water-resistive barrier coating (air/water-resistive barrier), an adhesive, expanded polystyrene insulation board, base coat, reinforcing mesh(es) and finish.

B. Methods of Installation

1. Field Applied: The Outsulation Plus System is applied to the substrate system in place.

C. Design Requirements:

1. Acceptable substrates for the Outsulation Plus System shall be:

a. Exterior grade gypsum sheathing meeting ASTM C 1396 (formerly C 79) requirements for water resistant core or Type X core at the time of application of the Outsulation Plus System.
b. Exterior sheathing having a water-resistant core with fiberglass mat facers meeting ASTM C 1177.
c. Exterior fiber reinforced cement or calcium silicate boards.
d. APA Exterior or Exposure 1 Rated Plywood, Grade C-D or better, nominal 12.7 mm (1/2 in) minimum 4-ply.
e. Unglazed brick, cement plaster, concrete or masonry.

2. Deflection of the substrate systems shall not exceed 1/240 times the span.
3. The substrate shall be flat within 6.4 mm (1/4 in) in a 1.2 m (4 ft) radius.
4. The slope of inclined surfaces shall not be less than 6:12, and the length shall not exceed 305 mm (12 in).
5. All areas requiring an impact resistance classification higher than "standard", as defined by ASTM E 2486 (formerly EIMA Standard 101.86), shall be as detailed in the drawings and described in the contract documents. Refer to Section 1.04.D.1.d of this specification.
6. Expansion Joints:

a. Design and location of expansion joints in the Outsulation Plus System is the responsibility of the project designer and shall be noted on the project drawings. As a minimum, expansion joints shall be placed at the following locations:

1) Where expansion joints occur in the substrate system.
2) Where building expansion joints occur.
3) At floor lines in wood frame construction.
4) At floor lines of non-wood framed buildings where significant movement is expected.

5) Where the Outsulation Plus System abuts dissimilar materials.
6) Where the substrate type changes.
7) Where prefabricated panels abut one another.
8) In continuous elevations at intervals not exceeding 23 m (75 ft).
9) Where significant structural movement occurs, such as changes in roof line, building shape or structural system.

7. Terminations

a. Prior to applying the Dryvit Outsulation Plus System, wall openings shall be treated with Dryvit AquaFlash System or Flashing Tape. Refer to Dryvit Outsulation Plus Installation Details (DS110).
b. The Outsulation Plus System shall be held back from adjoining materials around openings and penetrations such as windows, doors, and mechanical equipment a minimum of 19 mm (3/4 in) for sealant application. See Dryvit's Outsulation Plus System Installation Details, DS110.
c. The system shall be terminated a minimum of 203 mm (8 in) above finished grade.
d. Sealants

1) Shall be manufactured and supplied by others.
2) Shall be compatible with the Outsulation Plus System materials. Refer to current Dryvit Publication DS153 for listing of sealants tested by sealant manufacturer for compatibility.
3) The sealant backer rod shall be closed cell.

8. Vapor Retarders - The use and location of vapor retarders within a wall assembly is the responsibility of the project designer and shall comply with local building code requirements. The type and location shall be noted on the project drawings and specifications. Vapor retarders may be inappropriate in certain climates and can result in condensation within the wall assembly. Refer to Dryvit Publication DS159 for additional information.
9. Dark Colors - The use of dark colors must be considered in relation to wall surface temperature as a function of local climatic conditions. Use of dark colors in high temperature climates can affect the performance of the system.
10. Flashing: Shall be provided at all roof-wall intersections, windows, doors, chimneys, decks, balconies and other areas as necessary to prevent water from entering behind the Outsulation Plus System.

D. Performance Requirements: The Outsulation Plus System is designed as a drainage wall system and is detailed to discharge incidental moisture from within the System. Specifications should be followed and proper details adhered to, in order to prevent water intrusion, resulting in possible damage to the System or other building elements. Care should be taken to insure that all building envelope elements, including without limitations, roof designs, windows, flashings, sealants, etc., are compatible with this system.

1. The Outsulation Plus System shall have been tested as follows:

a. Air/Water-Resistive Barrier Coating
Tensile Bond: ASTM C 297/E 2134;
Freeze-thaw: ASTM E 2485/ICC-ES Proc.
Water Resistance :ASTM D 2247
Water Vapor Transmission: ASTM E 96 Proc. B
Air Leakage: ASTM E 283
Structural Performance: ASTM E 1233 Proc. A
Racking: ASTM E 72

Water Penetration: ASTM E331
Weathering: UV Exposure
Accelerated Aging: Hydrostatic Pressure Test
Surface Burning Characteristics: ASTM E 84

b. Durability
Abrasion Resistance :ASTM D 968
Accelerated Weathering: ASTM G 155 Cycle 1;ASTM G 154 Cycle 1 (QUV)
Freeze-Thaw: ASTM E 2485; ASTM C 67 modified; ASTM E 2485/ICC-ES Proc.
Mildew Resistance; ASTM D 3273
Water Resistance: ASTM D 2247
Taber Abrasion: ASTM D 4060
Salt Spray Resistance :ASTM B 117
Water Penetration: ASTM E 331
Water Vapor Transmission: ASTM E 96 Procedure B
Drainage Efficiency: ASTM E 2273

c. Structural: Tensile Bond: ASTM C 297/E 2134; Transverse Wind Load: ASTM E 330

d. Impact Resistance: In accordance with ASTM E 2486 (formerly EIMA Standard 101.86):

e. Fire performance: Fire Resistance ASTM E 119 ( 1 hour) ; Ignitability: NFPA 268 ( 20 minutes)

2. The Outsulation Plus components shall be tested for:

a. Fire Surface Burning Characteristics: ASTM E 84, All components shall have :
Flame Spread $\leq$ 25
Smoke Developed $\leq$ 450

b. Durability: Reinforcing Mesh
Alkali Resistance of Reinforcing Mesh: ASTM E 2098 (formerly EIMA 105.01)
EPS (Physical Properties): Density; Thermal Resistance, Water Absorption, Oxygen Index, Compressive Strength, Flexural Strength, Flame Spread, Smoke Developed : ASTM C 303, D 1622; ASTM C 177, C 518; ASTM C 272; ASTM D 2863; ASTM D 1621 Proc. A; ASTM C 203; ASTM E 84

## 1.5 SUBMITTALS

A. Product Data: The contractor shall submit to the owner/architect the manufacturer's product data sheets describing products, which will be used on this project.

B. Shop Drawings for Panelized Construction: The panel fabricator shall prepare and submit to the owner/architect complete drawings showing: wall layout, connections, details, expansion joints, and installation sequence.

C. Samples: The contractor shall submit to the owner/architect two (2) samples of the Outsulation Plus System for each finish, texture and color to be used on the project. The same tools and techniques proposed for the actual installation shall be used. Samples shall be of sufficient size to accurately represent each color and texture being utilized on the project.

D. Test Reports: When requested, the contractor shall submit to the owner/architect copies of selected test reports verifying the performance of the Outsulation Plus System.

## 1.6 QUALITY ASSURANCE

A. Qualifications

1. System Manufacturer: Shall be Dryvit Systems, Inc. All materials shall be manufactured or sold by Dryvit and shall be purchased from Dryvit or its authorized distributors.

    a. Materials shall be manufactured at a facility covered by a current ISO 9001:2000 certification. Certification of the facility shall be done by a registrar accredited by the American National Standards Institute, Registrar Accreditation Board (ANSI-RAB).

2. Contractor: Shall be knowledgeable in the proper installation of the Dryvit Outsulation Plus System and shall be experienced and competent in the installation of Exterior Insulation and Finish Systems. Additionally, the contractor shall possess a current Outsulation Plus System Trained Contractor Certificate* issued by Dryvit Systems, Inc.
3. Insulation Board Manufacturer: Shall be listed by Dryvit Systems, Inc., shall be capable of producing the Expanded Polystyrene (EPS) in accordance with the current Dryvit Specification for Insulation Board, DS131, and shall subscribe to the Dryvit Third Party Certification and Quality Assurance Program.

B. Regulatory Requirements:

1. The EPS shall be separated from the interior of the building by a minimum 15-minute thermal barrier.
2. The use and maximum thickness of EPS shall be in accordance with the applicable building code(s).

C. Certification

1. The Outsulation Plus System shall be recognized for the intended use by the applicable building code(s).

D. Mock-Up

1. The contractor shall, before the project commences, provide the owner/architect with a mock-up for approval.
2. The mock-up shall be of suitable size as required to accurately represent the products being installed, as well as each color and texture to be utilized on the project.
3. The mock-up shall be prepared with the same products, tools, equipment and techniques required for the actual applications. The finish used shall be from the same batch that is being used on the project.
4. The approved mock-up shall be available and maintained at the jobsite.
5. For panelized construction, the mock-up shall be available and maintained at the panel fabrication location.

1.7 DELIVERY, STORAGE AND HANDLING

A. All Dryvit materials shall be delivered to the job site in the original, unopened packages with labels intact.

B. Upon arrival, materials shall be inspected for physical damage, freezing or overheating. Questionable materials shall not be used.

1. Materials shall be stored at the jobsite in a cool, dry location, out of direct sunlight, protected from weather and other sources of damage. Minimum storage temperature shall be as follows:

    a. Demandit®, Revyvit®: 45 °F.

b. DPR, PMR™ and E™ Finishes, Color Prime™, Primus®, Genesis and NCB™: 40 °F.
c. For other products, refer to specific product data sheets.

2. Maximum storage temperature shall not exceed 100 °F. NOTE: Minimize exposure of materials to temperatures over 90 °F. Finishes exposed to temperatures over 110 °F for even short periods may exhibit skinning, increased viscosity and should be inspected prior to use.

C. Protect all products from inclement weather and direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Requirements

1. Application of wet materials shall not take place during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.
2. At the time of application, the minimum air and wall surface temperatures shall be as follows:

a. Demandit, Revyvit: 45 °F, DPR, PMR and E Finishes, Color Prime, Primus Genesis and NCB: 40 °F.
b. For other products, refer to specific product data sheets.

3. These temperatures shall be maintained with adequate air ventilation and circulation for a minimum of 24 hours thereafter, or until the products are completely dry. Refer to published product data sheets for more specific information.

B. Existing Conditions: The contractor shall have access to electric power, clean water and a clean work area at the location where the Dryvit materials are to be applied.

1.9 SEQUENCING AND SCHEDULING

A. Installation of the Outsulation Plus System shall be coordinated with other construction trades.

B. Sufficient manpower and equipment shall be employed to ensure a continuous operation, free of cold joints, scaffold lines, texture variations, etc.

1.10 WARRANTY

A. Dryvit Systems, Inc. shall provide a written moisture drainage and limited materials warranty against defective material upon written request.

B. The applicator shall warrant workmanship

1.11 MAINTENANCE

A. Maintenance and repair shall follow the procedures noted in the Dryvit Outsulation Plus System Application Instructions, DS218.

B. All Dryvit products are designed to minimize maintenance. However, as with all building products, depending on location, some cleaning may be required. See Dryvit publication DS152 on Cleaning and Recoating.

C. Sealants and Flashings shall be inspected on a regular basis and repairs made as necessary.

PART II PRODUCTS

2.1 MANUFACTURER

A. All components of the Outsulation Plus System shall be supplied or obtained from Dryvit or its authorized distributors. Substitutions or additions of materials other than specified will void the warranty.

2.2 MATERIALS

A. Portland Cement: Shall be Type I or II, meeting ASTM C 150, white or gray in color, fresh and free of lumps.

B. Water: Shall be clean and free of foreign matter.

2.3 COMPONENTS

A. Air/Water-Resistive Barrier Components:

1. Dryvit Backstop® NT: A flexible, polymer-based noncementitious water-resistive coating available in Texture and Smooth.
2. Dryvit Grid Tape™: An open weave fiberglass mesh tape with pressure sensitive adhesive available in rolls 4 in wide by 100 yds. long.

B. Flashing Materials: Used to protect substrate edges at terminations.

1. Liquid Applied: An extremely flexible water-based polymer material, ready for use.

a. Shall be AquaFlash and AquaFlash Mesh

2. Sheet Type:

a. Shall be Flashing Tape and Surface Conditioner

1) Dryvit Flashing Tape™: A high density polyethylene film backed with a rubberized asphalt adhesive available in rolls 4 in, 6 in and 9 in wide by 75 ft long.
2) Dryvit Flashing Tape Surface Conditioner™: A water-based surface conditioner and adhesion promoter for the Dryvit Flashing Tape.

C. Dryvit AP Adhesive™: A moisture cure, urethane-based adhesive used to adhere the Dryvit Drainage Strip and Drainage Track.

D. Drainage Track: UV treated PVC "J" channel perforated with weep holes, complying with ASTM D 1784 and ASTM C 1063. Drainage track usage is limited to the base of the system at finished grade level. All other horizontal terminations shall utilize the Dryvit Drainage Strip as shown in Outsulation Plus Installation Details, DS110. Shall be one of the following:

1. Starter Trac STWP – without drip edge by Plastic Components, Inc.
2. Starter Trac STDE – with drip edge by Plastic Components, Inc.
3. Universal Starter Track by Wind-lock Corporation
4. Sloped Starter Strip with Drip by Vinyl Corp.

E. Dryvit Drainage Strip™: A corrugated plastic sheet material, which provides drainage.

F. Adhesives: Used to adhere the EPS to the air/water-resistive barrier, shall be compatible with the water-resistive barrier and the EPS.

1. Cementitious: A liquid polymer-based material, which is field mixed with Portland cement.

a. Shall be Primus, Genesis or Genesis® FM

2. Ready mixed: A dry blend cementitious, copolymer-based product, field mixed with water.

a. Shall be Primus® DM, Genesis® DM, Genesis® DMS, Rapidry DM 35-50 or Rapidry DM 50-75

G. Insulation Board: Expanded Polystyrene meeting Dryvit Specification for Insulation Board, DS131.

1. Thickness of insulation board shall be minimum 1 in.
2. The insulation board shall be manufactured by a board supplier listed by Dryvit Systems, Inc.

H. Base Coat: Shall be compatible with the EPS insulation board and reinforcing mesh(es).

1. Cementitious: A liquid polymer-based material, which is field mixed with Portland cement.

a. Shall be Primus, Genesis or Genesis FM

2. Noncementitious: A factory-mixed, fully formulated, water-based product.

a. Shall be NCB

3. Ready mixed: A dry blend cementitious, copolymer-based product, field mixed with water.

a. Shall be Primus DM, Genesis DM, Genesis DMS, Rapidry DM 35-50 or Rapidry DM 50-75.

I. Reinforcing Mesh: A balanced, open weave, glass fiber fabric treated for compatibility with other system materials. NOTE: Reinforcing meshes are classified by impact resistance and specified by weight and tensile strength as listed in Section 1.04.D.1.d.

1. Shall be Intermediate (surfaces above 9’-0 AFF), Panzer 20 (surfaces from grade to 9’-0 AFF), Detail and Corner Mesh or closet control joint.

J. Finish: Shall be the type, color and texture as selected by the architect/owner and shall be one or more of the following:

1. Standard DPR (Dirt Pickup Resistance): Water-based, acrylic coating with integral color and texture and formulated with DPR chemistry: Selected by Architect from full range of manufacturers standard textures:

a. Quarzputz® DPR: Open-texture
b. Sandblast® DPR: Medium texture
c. Freestyle® DPR: Fine texture
d. Sandpebble® DPR: Pebble texture
e. Sandpebble® Fine DPR: Fine pebble texture

2. Coatings, Primers and Sealers:

a. Demandit
b. Weatherlastic® Smooth
c. Tuscan Glaze™
d. Revyvit
e. Color Prime
f. Prymit®
g. SealClear™

PART III EXECUTION

3.1 EXAMINATION

A. Prior to installation of the Outsulation Plus System, the contractor shall verify that the substrate:

1. Is of a type listed in Section 1.04.C.1.
2. Is flat within 1/4 inch in a 4 ft. radius.
3. Is sound, dry, connections are tight; has no surface voids, projections, or other conditions that may interfere with the Outsulation Plus System installation or performance.

B. Prior to installation of the Outsulation Plus System, the architect or general contractor shall insure that all needed flashings and other waterproofing details have been completed, if such completion is required prior to the Outsulation Plus application. Additionally the Contractor shall ensure that:

1. Metal roof flashing has been installed in accordance with Asphalt Roofing Manufacturers Association (ARMA) Standards.
2. Openings are flashed in accordance with the Outsulation Plus System Installation Details, DS110, or as otherwise necessary to prevent water penetration.
3. Chimneys, Balconies and Decks have been properly flashed.
4. Windows, Doors, etc. are installed and flashed per manufacturer's requirements and the Outsulation Plus System Installation Details, DS110.

C. Prior to the installation of the Outsulation Plus System, the contractor shall notify the general contractor, and/or architect, and/or owner of all discrepancies.

3.2 PREPARATION

A. The Outsulation Plus materials shall be protected by permanent or temporary means from inclement weather and other sources of damage prior to, during, and following application until completely dry.

B. Protect adjoining work and property during Outsulation Plus installation.

C. The substrate shall be prepared as to be free of foreign materials, such as oil, dust, dirt, form-release agents, efflorescence, paint, wax, water repellants, moisture, frost, and any other condition that may inhibit adhesion.

3.3 INSTALLATION

A. The system shall be installed in accordance with the Dryvit Outsulation Plus System Application Instructions, DS218.

B. The overall minimum base coat thickness shall be sufficient to fully embed the mesh. The recommended method is to apply the base coat in two (2) passes.

C. Sealant shall not be applied directly to textured finishes or base coat surfaces. Dryvit Outsulation Plus System surfaces in contact with sealant shall be coated with Demandit or Color Prime.

D. High impact meshes shall be installed as specified at ground level, high traffic areas and other areas exposed to or susceptible to impact damage.

3.4 FIELD QUALITY CONTROL

A. The contractor shall be responsible for the proper application of the Outsulation Plus materials.

B. Dryvit assumes no responsibility for on-site inspections or application of its products.

C. If required, the contractor shall certify in writing the quality of work performed relative to the substrate system, details, installation procedures, workmanship and as to the specific products used.

D. If required, the EPS supplier shall certify in writing that the EPS meets Dryvit's specifications.

E. If required, the sealant contractor shall certify in writing that the sealant application is in accordance with the sealant manufacturer's and Dryvit's recommendation.

3.5 CLEANING

A. All excess Outsulation Plus System materials shall be removed from the job site by the contractor in accordance with contract provisions and as required by applicable law.

B. All surrounding areas, where the Dryvit Outsulation Plus System has been applied, shall be left free of debris and foreign substances resulting from the contractor’s work.

3.6 PROTECTION

A. The Outsulation Plus System shall be protected from inclement weather and other sources of damage until dry and permanent protection in the form of flashings, sealants, etc. are installed.

END OF SECTION 072400


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# SECTION 072700 - FIRESTOPPING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes firestopping for the following:

1. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
2. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.

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

1. Division 4 Section "Unit Masonry" for joint fillers for non-fire-resistive-rated masonry construction.
2. Division 15 Sections specifying ducts and piping penetrations.
3. Division 16 Sections specifying cable and conduit penetrations.

### 1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

B. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

### 1.4 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product specified.

1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

C. Shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop configuration for construction and penetrating items.
2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration approved by firestopping manufacturer's fire protection engineer with modifications marked.

D. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.

E. Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.

F. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

## 1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water (2.5 Pa) is maintained at a distance of 0.78 inch (20 mm) below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:

    a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
    b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by Warnock Hersey, or by another qualified testing and inspecting agency.

3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water (2.5 Pa), as measured 0.78 inch (20 mm) from the face exposed to furnace fire. Provide systems complying with the following requirements:

    a. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
    b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.

B. Information on drawings referring to specific design designations of through-penetration firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.

C. Installer Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

D. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.

E. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

F. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

## 1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

## 1.8 SEQUENCING AND SCHEDULING

A. Do not cover up those firestopping installations that will become concealed behind other construction until Owner's inspection agency and authorities having jurisdiction, if required, have examined each installation.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:

1. Permanent forming/damming/backing materials including the following:

a. Semirefractory fiber (mineral wool) insulation.
b. Ceramic fiber.
c. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
d. Fire-rated formboard.
e. Joint fillers for joint sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.2 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

A. Ceramic-Fiber and Mastic Coating: Ceramic fibers in bulk form formulated for use with mastic coating, and ceramic fiber manufacturer's mastic coating.

B. Ceramic-Fiber Sealant: Single-component formulation of ceramic fibers and inorganic binders.

C. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.

D. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.

E. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.

G. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.

H. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.

I. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

J. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.

K. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
2. Grade for Horizontal Surfaces: Pourable (self-leveling) grade for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag grade for openings in vertical and other surfaces.

L. Solvent-Release-Curing Intumescent Sealant: Solvent-release-curing, single-component, synthetic-polymer-based sealant of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
2. Grade for Horizontal Surfaces: Pourable (self-leveling) grade for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag grade for openings in vertical and other surfaces.

M. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

N. Products: Subject to compliance with requirements, provide one of the following:

1. Ceramic-Fiber and Mastic Coating:

    a. FireMaster Bulk and FireMaster Mastic, Thermal Ceramics.

2. Ceramic-Fiber Sealant:

    a. Metacaulk 525, The RectorSeal Corporation.

3. Endothermic, Latex Sealant:

    a. Fyre-Shield, Tremco Inc.

4. Endothermic, Latex Compounds:

    a. Flame-Safe FS500/600 Series, International Protective Coatings Corp.
    b. Flame-Safe FS900/FST900 Series, International Protective Coatings Corp.

5. Intumescent Latex Sealant:

a. Metacaulk 950, The RectorSeal Corporation.
b. Fire Barrier CP 25WB Caulk, 3M Fire Protection Products.

6. Intumescent Putty:

a. Pensil 500 Intumescent Putty, General Electric Co.
b. Flame-Safe FSP1000 Putty, International Protective Coatings Corp.
c. Fire Barrier Moldable Putty, 3M Fire Protection Products.

7. Intumescent Wrap Strips:

a. Dow Corning Fire Stop Intumescent Wrap Strip 2002, Dow Corning Corp.

b. CS2420 Intumescent Wrap, Hilti Construction Chemicals, Inc.
c. Fire Barrier FS-195 Wrap/Strip, 3M Fire Protection Products.

8. Job-Mixed Vinyl Compound:

a. USG Firecode Compound, United States Gypsum Co.

9. Mortar:

a. K-2 Firestop Mortar, Bio Fireshield, Inc.
b. Novasit K-10 Firestop Mortar, Bio Fireshield, Inc.
c. KBS-Mortar Seal, International Protective Coatings Corp.

10. Pillows/Bags:

a. Firestop Pillows, Bio Fireshield, Inc.
b. KBS Sealbags, International Protective Coatings Corp.

11. Silicone Foams:

a. Dow Corning Fire Stop Foam 2001, Dow Corning Corp.
b. Pensil 200 Foam, General Electric Co.

12. Silicone Sealants:

a. Dow Corning Firestop Sealant 2000, Dow Corning Corp.
b. Dow Corning Firestop Sealant SL 2003, Dow Corning Corp.
c. Pensil 100 Firestop Sealant, General Electric Co.
d. CS240 Firestop Sealant, Hilti Construction Chemicals, Inc.
e. Metacaulk 835, The RectorSeal Corporation.
f. Metacaulk 880, The RectorSeal Corporation.
g. Fyre-Sil, Tremco Inc.
h. Fyre-Sil S/L, Tremco Inc.

13. Solvent-Release-Curing Intumescent Sealants:

a. Biostop 500 Intumescent Firestop Caulk, Bio Fireshield, Inc.
b. Fire Barrier CP 25N/S Caulk, 3M Fire Protection Products.
c. Fire Barrier CP 25S/L Caulk, 3M Fire Protection Products.

## 2.3 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.

B. Sealant Colors: Provide color of exposed joint sealants to comply with the following:

1. Provide custom colors to match Architect's samples.
2. Match colors indicated by reference to manufacturer's standard designations.
3. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

C. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.

1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage changes in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:

a. 50 percent movement in both extension and compression for a total of 100 percent movement.
b. 100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement.

D. Multicomponent, Nonsag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.

1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage change in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:

a. 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement.
b. 50 percent movement in both extension and compression for a total of 100 percent movement.

E. Single-Component, Nonsag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.

F. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

G. Products: Subject to compliance with requirements, provide one of the following:

1. Single-Component, Neutral-Curing, Silicone Sealant:

a. Dow Corning 790, Dow Corning Corp.
b. Dow Corning 795, Dow Corning Corp.
c. Silpruf, General Electric Co.
d. Ultraglaze, General Electric Co.
e. 864, Pecora Corp.

2. Multicomponent, Nonsag, Urethane Sealant:

   a. Vulkem 922, Mameco International Inc.
   b. Dynflex, Pecora Corp.
   c. Dynatred, Pecora Corp.
   d. Dynatrol II, Pecora Corp.
   e. Sikaflex 2cn NS, Sika Corp.
   f. Sonolastic NP 2, Sonneborn Building Products Div., ChemRex Inc.
   g. Dymeric, Tremco Inc.

3. Single-Component, Nonsag, Urethane Sealant:

   a. Isoflex 880 GB, Harry S. Peterson Co., Inc.
   b. Isoflex 881, Harry S. Peterson Co., Inc.
   c. Vulkem 921, Mameco International Inc.
   d. Sikaflex--15LM, Sika Corp.

## 2.4 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping 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 firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

   1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
   2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping 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 firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

## 3.3 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
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 Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

## 3.4 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

## 3.5 FIELD QUALITY CONTROL

A. Inspecting agency employed and paid by Owner will examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.

B. Inspecting agency will report observations promptly and in writing to Contractor and Architect.

C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.

D. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.6 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION 07270

# SECTION 072726 - 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 fluid-applied, vapor-retarding membrane air barriers.

B. Related Requirements:

1. Section 061600 "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 accessory materials 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 substrate; technical data; and tested physical and performance properties of products.

1.6 INFORMATIONAL SUBMITTALS

A. 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.

B. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.7 QUALITY ASSURANCE

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

B. Mockups: Build mockups to set quality standards for materials and execution.

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 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, GENERAL

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

2.2 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding 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, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum when tested according to ASTM E 283.

2.3 VAPOR-RETARDING MEMBRANE AIR BARRIER

A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous membrane.

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. Elastomeric, Modified Bituminous Membrane:

1) Hohmann & Barnard, Inc.; Textroflash Liquid.
2) Meadows, W. R., Inc.; Air-Shield LM.

2. Physical and Performance Properties:

a. Vapor Permeance: Maximum 0.03 Perms; ASTM E 96/E 96M.
b. Ultimate Elongation: Minimum 1500 percent; ASTM D 412.

2.4 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.

B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.

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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. 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. 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.

E. 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.

## 3.3 JOINT TREATMENT

A. Gypsum Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

## 3.4 FLUID AIR-BARRIER MEMBRANE INSTALLATION

A. General: Apply fluid 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. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.

1. Apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.

1. Vapor-Retarding Membrane Air Barrier: Total [dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 45-mil (1.0-mm) dry film thickness..

C. Do not cover air barrier until it has been tested and inspected by Owner's 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. Testing Agency: Owner may, at his option, engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air-barrier system has been provided.
3. Site conditions for application temperature and dryness of substrates have been maintained.
4. Maximum exposure time of materials to UV deterioration has not been exceeded.
5. Surfaces have been primed, if applicable.

6. 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.
7. Termination mastic has been applied on cut edges.
8. Strips and transition strips have been firmly adhered to substrate.
9. Compatible materials have been used.
10. Transitions at changes in direction and structural support at gaps have been provided.
11. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
12. All penetrations have been sealed.

C. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

## 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 required by manufacturer. If exposed to these conditions for more than [30] [60] <Insert number> days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane 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 by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726


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ARCHITECTS PROGRAMMERS PLANNERS

# SECTION 073213 - CLAY ROOF TILES

## 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 roof tiles – new to supplement and blend with old tile for consistent color.
2. Underlayment.
3. Removal and storage of existing clay tile until it can be reinstalled.

B. Related Sections:

1. Section 061500 "Wood Decking" for solid-wood roof decking.
2. Section 061600 "Sheathing" for roof sheathing.

### 1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079, glossaries in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

### 1.4 ACTION SUBMITTALS

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

B. Samples: For the following products, in manufacturer's standard sizes:

1. Clay Roof Tile: Full size.
2. Accessory Tile: Full size, each type.
3. Fasteners: One of each for tile and accessories.

### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing to include in maintenance manuals.

### 1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Clay Roof Tiles: 100 sq. ft.. Shrink wrap on pallets and store on South Campus.

## 1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain clay roof tiles and accessory tiles from single source from single manufacturer. Ludowici-Celadon is the tile used on MSU Campus and is required for this project.

B. Fire-Test-Response Characteristics: Provide clay roof tiles and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; UL 790 or ASTM E 108, for application and roof slopes indicated.

C. Preinstallation Conference: Conduct conference at Project site.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double stack rolls.

1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

## 1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be performed according to manufacturer's written instructions and warranty requirements.

1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

## 1.10 WARRANTY

A. Special Project Warranty: Roofing Installer's Warranty, on warranty form at end of this Section, signed by roofing Installer, covering Work of this Section, in which roofing Installer agrees to repair or replace components of roofing that fail in materials or workmanship within the following warranty period:

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CLAY ROOF TILES

A. Clay Roof Tiles: ASTM C 1167, molded- or extruded-clay roof tile units of shape and configuration indicated, kiln fired to verification, and free of surface imperfections. Provide with fastening holes prepunched at factory before firing.

1. Manufacturers: Subject to compliance with requirements, provide products by Ludowici-Celadon.
2. Blend: to match existing roof at Bolin Science Building and adjacent areas with Clay Tile. Prior buildings have used the following blend but must be verified at the site:
   14% SO/M10/M23 “Weathered Mist”
   32% SO/296-04M/MS “Weathered Mist”
   54% SO/428-04M “Weathered Mist”.
3. Full cornered Spanish “S” Tile, 9 – 3/6” x 13 ¼”. Exposure: 8 ¼” x 10 ¼” long.
4. Eaves Special Size: Standard 7 ¼” long; 10 ¼” long; 13 ¼” long.
5. Laid tile in eve in sequence, illustrated in 4 above to create diagonal pattern in field.

2.2 ACCESSORIES

A. Roofing Felts: 30# asphalt impregnated imperforated organic felt.

B. Wood Products: Pressure treated ¾” plywood 48/24 index.

C. Wood Nailers: Pressure treated wood.

D. Mortar: ASTM C 270, Type N, pigmented mortar matching the color of clay roof tiles for exposed-to-view mortar, and natural color for concealed-from-view mortar.

E. H. Mastic: CSI single component FS TT-S-230..

F. Wood Nailers: Comply with requirements for pressure-preservative-treated wood in Section 061000 "Rough Carpentry."

G. Paint: Latex house paint equal to P & L Vapex House Paint, color to match.

H. Trim Pieces: Eve closers, circular cover hip starter, top fixtures, eve band, circular cover hip and ridge.

2.3 FASTENERS

A. Roofing Nails: ASTM F 1667, hot-dip galvanized-steel, 11 guage, diameter shank, sharp-pointed, conventional roofing nails with barbed shanks; minimum 3/8-inch- diameter head; of sufficient length to penetrate 3/4 inch into roof-deck sheathing.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

B. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch minimum diameter.

2.4 UNDERLAYMENT MATERIALS

A. Felt Underlayment: ASTM D 226, Type II, asphalt-saturated organic felt, unperforated, 30#, a minimum of three layers.

2.5 METAL FLASHING AND TRIM

A. General: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

1. Sheet Metal: Zinc-tin alloy-coated steel.

B. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."

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.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provision has been made for flashings and penetrations through roofing.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencing roofing operations is acceptance of substrate and project conditions.

3.2 UNDERLAYMENT INSTALLATION

A. General: Comply with clay roof tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

1. Cover ridge and hip wood nailers with underlayment strips.

B. Triple-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Install a 19-inch- wide starter course at eaves and completely cover with full-width second course. Install succeeding courses lapping previous courses 12 inches in shingle fashion. Lap ends a minimum of 6 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with felt underlayment nails.

## 3.3 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

## 3.4 WOOD NAILERS AND BATTENS

A. Install wood nailers at ridges, hips and rakes and securely fasten to roof deck.

B. Install beveled wood cant at eaves and securely fasten to roof deck.

## 3.5 CLAY ROOF TILE INSTALLATION

A. General: Install clay roof tiles according to manufacturer's written instructions, to recommendations in TRI/WSRCA's "Concrete and Clay Roof Tile Design Criteria Installation Manual for Moderate Climate Regions," and to NRCA's "The NRCA Roofing and Waterproofing Manual."

1. Maintain uniform exposure and coursing of clay roof tiles throughout roof to provide a diagonal pattern.
2. Extend tiles 2 inches over eave fasciae.
3. Nail Fastening: Drive nails to clear the clay roof tile so the tile hangs from the nail and is not drawn up.
4. Cut and fit clay roof tiles neatly around roof vents, pipes, ventilators, and other projections through roof. Fill voids with mortar.
5. Install clay roof tiles with color blend approved by Architect.

## 3.6 ADJUSTING AND CLEANING

A. Remove and replace damaged or broken clay roof tiles.

B. Remove excess clay roof tiles and debris from Project site.

END OF SECTION 073213


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# SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

## 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. Adhered TPO membrane roofing system.
2. Roof insulation.
3. Base Flashing.
4. Walk Pads.

B. Related Sections:

1. Section 061000 "Rough Carpentry for wood nailers, curbs, and blocking.
2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
3. Section 077129 "Manufactured Roof Expansion Joints" for proprietary manufactured roof expansion-joint assemblies.
4. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

### 1.3 DEFINITIONS

A. TPO: Thermoplastic polyolefin.

B. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

### 1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: Class 1A-90.

D. Solar Reflectance Index: Not less than .76 when calculated according to ASTM C 1549, based on testing identical products by a qualified testing agency.

E. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for ASTM D 6878.

F. Energy Performance: Provide roofing system with initial solar reflectance not less than 0.76 and emissivity not less than 0.90 when tested according to CRRC and ASTM C 1371.

## 1.5 ACTION SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples: For the following products:

1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
2. Roof insulation.
3. Walkway pads or rolls.
4. Metal termination bars.
5. Six insulation fasteners of each type, length, and finish.

## 1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

D. Warranties: The current roof is a GAF 45 Mil TPO 15 year roof warranty beginning 10/17/2008. The new roof shall match the existing and the existing roof warranty must be maintained as the roof warranty connects to the existing.

## 1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed FM Approvals approved for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

C. Source Limitations: Obtain components including fasteners adhesives for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

D. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, roofing Installer, roofing system manufacturer's representative, deck 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. Review deck substrate requirements for conditions and finishes, 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 will affect 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.

E. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, roofing Installer, roofing system manufacturer's representative, deck 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 will affect 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.

1.9 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. Protect stored liquid material from direct sunlight.

1. 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. Store in a dry location. 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.

1.10 PROJECT 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.

B. Proceed only when roof deck, including attachment, roof deck deflection, is accepted by roofer and roofing manufacturer.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, walk boards, roofing accessories, and other components of membrane roofing system.
2. Warranty Period: 15 years from date of Substantial Completion. NDL (No Dollar Limit).

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, , and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TPO MEMBRANE ROOFING

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible TPO sheet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle SynTec Incorporated.
b. Firestone Building Products Company.
c. GAF Materials Corporation.
d. Johns Manville.

2. Thickness: 60 mils, nominal.
3. Exposed Face Color: White.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils thick, minimum, of same color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard.

D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

F. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.3 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/4 inch thick.

1. Products: Subject to compliance with requirements, provide the following:

a. Georgia-Pacific Corporation; Dens Deck Prime Roof Board.

B. 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 equal to DRILL-TEC with 3” NTB plate.

## 2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, glass-fiber mat facer on both major surfaces.

1. 3.7 inches or thickness as shown on drawings.
2. Thermal resistant (LTTR Value) of 23.3.

## 2.5 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer, same color as roof membrane.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood 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 053100 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected. Beginning roofing operations is acceptance of roof deck as adequate for roofing operations and when complete will be warranted.

## 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. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. 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. Remove and discard temporary seals before beginning work on adjoining roofing.

## 3.3 SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
2. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

## 3.4 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

H. 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. Loosely butt cover boards together and fasten to roof deck.

1. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

## 3.5 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

I. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system.

## 3.6 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner may at his option engage a qualified testing agency to perform tests and inspections.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing 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 membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane 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 075423


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# SECTION 076200 - SHEET METAL FLASHING AND TRIM

## 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. Formed Products:

a. Wall Coping.
b. Counter Flashing.
c. Valley Flashing
d. Miscellaneous trim.
e. Pre-finished gutters and down spouts.

B. Related Sections:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.

### 1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated 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. Fabricate and install copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

1. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft.: 60-lbf/sq. ft. perimeter uplift force, 90-lbf/sq. ft. corner uplift force, and 30-lbf/sq. ft. outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient, material surfaces.

### 1.4 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 each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.

C. Samples: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full-size Sample.

## 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified fabricator.

B. Warranty: Sample of special warranty.

## 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

## 1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that 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.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup, Wall Coping including supporting construction cleats, seams, attachments and accessories.
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.

D. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

## 1.9 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which 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. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 15 years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
2. Exposed Coil-Coated Finish:

    a. Fluoropolymer Equal to Kynar 500: 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.
3. Surface: Smooth, flat.
4. Color: As selected by Architect from manufacturer’s full range.
5. 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.

## 2.2 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. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
3. 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, a unit of W. R. Grace & Co.; Ultra.
    c. Henry Company; Blueskin PE200 HT.
    d. Metal-Fab Manufacturing, LLC; MetShield.
    e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

## 2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and 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[ or manufactured item].

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

    a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
    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 Zinc-Tin Alloy-Coated Stainless-Steel Sheet: Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric [polyurethane] [polysulfide] [silicone] polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

G. 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.

## 2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Parapet Scuppers: Fabricate scuppers of dimensions required 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 Fabricate from the following materials:

1. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch thick.

## 2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.

1. Coping Profile: Refer to Drawings.
2. Joint Style: Butt, with 6-inch- wide, exposed cover plates.
3. Fabricate from the following materials:
   a. Zinc-Tin Alloy-Coated Stainless Steel: 0.024 inch thick.

B. Base Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

C. Counterflashing: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.

## 2.7 GUTTERS, DOWN SPOUTS AND TRIM

A. Flashing and Trim: Form from 0.0179-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent roof or wall panels.
   1. Opening Trim: Minimum 0.028-inch- thick steel sheet. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

B. Gutters: Form from 0.0179-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced 24 inches o.c., fabricated from same metal as gutters. Provide bronze, copper, or aluminum wire ball strainers at outlets. Finish gutters to match roof fascia and rake trim. Color as selected by Architect.

1. Gutters: Join sections with riveted, lapped and. Attach gutters to eaves with gutter hangers spaced not more than 4 feet (1.2 m) o.c. using manufacturer's standard

fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

C. Downspouts: Form from 0.0179-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; in 10-foot- long sections, complete with formed elbows and offsets. Finish downspouts to match wall panels. Color as selected by Architect. Downspout size minimum 4” deep – 6” wide.

1. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 48 inches (1500 mm) o.c. in between.
   a. Provide elbow at base of downspout to direct water away from building.
   b. Tie downspouts to underground drainage system indicated.

## 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.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails 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 with roller. Cover underlayment within 14 days.

### 3.3 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, welding rods, 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 and levels indicated. 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. Continuous cleats spaced at 24” o.c. Anchor each cleat with fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

F. Rivets: Rivet joints in zinc coated same color as coping where indicated and where necessary for strength.

## 3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements[, sheet metal manufacturer's written installation instructions,] and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
2. Anchor interior leg of coping with screw fasteners and washers at 24-inch centers.

## 3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

## 3.6 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. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200


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# SECTION 077200 - 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. Roof Hatches.
3. Access Ladder.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for metal vertical ladders, for access to roof hatches.
2. Section 055213 "Pipe and Tube Railings" for safety railing systems not attached to roof-hatch curbs.
3. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
4. Section 233423 "HVAC Power Ventilators" for power roof-mounted ventilators.

### 1.3 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.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories. 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.

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. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 COORDINATION

A. 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.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.

C. 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.

D. 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 Aluminum Sheet: Aluminum or Series 300 stainless steel.

E. 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.

F. Elastomeric Sealant: ASTM C 920, elastomeric 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.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.3 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; with welded or mechanically fastened and sealed corner joints and integrally formed deck-mounting flange at perimeter bottom. Curbs associated with rooftop HVAC units shall be provided by the Mechanical Sub-Contractor.

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. AES Industries, Inc.
   b. Curbs Plus, Inc.
   c. Greenheck Fan Corporation.
   d. LM Curbs.
   e. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: Aluminum sheet, 0.090 inch thick.

1. Finish: Mill.

D. Construction:

1. Insulation: Factory insulated with 1-1/2-inch- thick fiber board insulation.
2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
4. Fabricate curbs to minimum height of 18 inches unless otherwise indicated.
5. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
6. 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.

2.4 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing 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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

a. AES Industries, Inc.
b. Bilco Company (The).
c. J. L. Industries, Inc.
d. Metallic Products Corp.
e. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
f. Naturalite Skylight Systems; Vistawall Group (The).
g. O'Keeffe's Inc.

B. Type and Size: Single-leaf lid, 36” x 36”; the Bilco Company, 36” x 36” Model #EF-56.

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material: Aluminum sheet, 0.090 inch thick.

1. Finish: Mill.

E. Construction:

1. Insulation: Polyisocyanurate board.
2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
4. Fabricate curbs to minimum height of 18 inches unless otherwise indicated.
5. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant. Equip hatch with water diverter or cricket on side that obstructs water flow.

F. Hardware: Stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

2.5 ACCESS LADDER WITH CAGE

A. Access Ladder equal to Precision Ladders, LLC.
1. Fixed Aluminum Wall Ladder with cage, Model FL.
2. Five (5) Year Warranty.
3. Extruded Aluminum (6005-T5).
4. 1500 lb. Loading.

2.6 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. General: 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, excessive oil canning, 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 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 felt underlayment and cover with a slip sheet, or install a course of polyethylene 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. Roof-Hatch Installation:

1. Install roof hatch so top surface of hatch curb is level.

2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
3. Attach safety railing system to roof-hatch curb.
4. Attach ladder-assist post according to manufacturer's written instructions.

E. Seal joints with elastomeric or 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 A 780.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting" and Section 099123 "Interior 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 077200

# SECTION 079200 - JOINT SEALANTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes sealants for the following applications, including those specified by reference to this Section:

B. This Section includes sealants for the following applications:

1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:

a. Control and expansion joints in unit masonry.
b. Perimeter joints between materials listed above and frames of doors and windows.
c. Other joints as indicated.

C. Related Sections include the following:

1. Division 2 Section "Pavement Joint Sealants" for sealing joints in pavements, walkways, and curbing.
2. Division 4 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.

### 1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

### 1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for 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. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

D. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F (4.4 deg C).
3. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS AND MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in the sealant schedules at the end of Part 3.

### 2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

### 2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

B. Additional Movement Capability: Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.

C. Stain-Test-Response Characteristics: Where elastomeric sealants are specified in the Elastomeric Joint-Sealant Schedule to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Continuous-Immersion-Test-Response Characteristics: Where elastomeric sealants will be immersed continuously in water, provide products that have undergone testing according to ASTM C 1247, including initial six-week immersion period and additional immersion periods specified below, and have not failed in adhesion or cohesion when tested with substrates indicated for Project.

1. Three additional four-week immersion periods.

E. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

### 2.4 LATEX JOINT SEALANTS

A. Latex Sealant Standard: Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

## 2.5 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.
2. Type O: Open-cell material.
3. Type B: Bicellular material with a surface skin.
4. Type: Any material indicated above.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

1. Provide single or double backing to adequately close joint regardless of depth. Some locations may require multiple layers of “roap and caulk”.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.6 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 with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

## 3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

E. Install sealants by proven techniques to 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 provided for 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 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 sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
5. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.

a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

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 elastomeric sealant joints as follows:

a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each type of elastomeric sealant and joint substrate.

2. Test Method: Test joint sealants by hand-pull method described below:

a. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches (50 mm) long at sides of joint and meeting cross cut at one end. Place a mark 1 inch (25 mm) from cross-cut end of 2-inch (50-mm) piece.
b. Use fingers to grasp 2-inch (50-mm) piece of sealant between cross-cut end and 1-inch (25-mm) mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
c. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.

4. Inspect tested joints and report on the following:

    a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field- adhesion hand-pull test criteria.
    b. Whether sealants filled joint cavities and are free from voids.
    c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
6. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

B. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

## 3.5 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

## 3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

## 3.7 ELASTOMERIC JOINT-SEALANT SCHEDULE

A. Single-Component Nonsag Urethane Sealant: Vertical Expansion Joints and elsewhere, where joint sealants of this type are indicated, provide products complying with the following:

1. Products:

    a. Sikaflex - 1a; Sika Corporation.
    b. NP 1; Sonneborn Building Products Div., ChemRex Inc.

2. Type and Grade: S (single component) and NS (nonsag).

B. Coordinate with Outsulation Plus Drivit EIFS system for sealant acceptable to DRIVIT warranty.

1. Tremco Inc.

a. Sealant: Spectrem 1, 3 & 4.
b. Primer: Tremprime Silicone Porous Primer.

2. Sika Corporation

a. Sealant: Sikaflex 2C
b. Primer: Sikaflex 429

3.8 LATEX JOINT-SEALANT SCHEDULE

A. Latex Sealant: Where joint sealants of this type are indicated, provide products complying with the following:

1. Products:

a. AC-20; Pecora Corporation.
b. Sonolac; Sonneborn Building Products Div., ChemRex, Inc.
c. Tremflex 834; Tremco.

END OF SECTION 079200

# SECTION 081113 - STEEL 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 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes steel doors and frames.

1. Exterior and Interior steel doors and frames
2. Interior Steel Window Frames.

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

1. Division 4 Section "Unit Masonry" for building anchors into and grouting frames in masonry construction.
2. Division 8 Section "Flush Wood Doors" for hollow-core and solid-core wood doors installed in steel frames.
3. Division 8 Section "Door Hardware" for door hardware and weatherstripping.
4. Division 8 Section "Glazing" for glass in steel doors and sidelights.
5. Division 9 Section "Painting" for field painting primed doors and frames.

### 1.3 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 each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

C. Shop Drawings showing fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

D. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.

1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

### 1.4 QUALITY ASSURANCE

A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified.

B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per ASTM E 152, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturer products that must be incorporated in the Work is the following:

1. Steel Doors and Frames: (No exceptions, or substitutions to list provided.)

a. Steelcraft.
b. CECO

2.2 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial-quality carbon steel, pickled and oiled, complying with ASTM A 569 (ASTM A 569M).

B. Cold-Rolled Steel Sheets: Carbon steel complying with ASTM A 366 (ASTM A 366M), commercial quality, or ASTM A 620 (ASTM A 620M), drawing quality, special killed.

C. Galvanized Steel Sheets: Zinc-coated carbon steel complying with ASTM A 526 (ASTM A 526M), commercial quality, or ASTM A 642 (ASTM A 642M), drawing quality, hot-dip galvanized according to ASTM A 525, with A 60 or G 60 (ASTM A 525M, with Z 180 or ZF 180) coating designation, mill phosphatized.

D. Supports and Anchors: Fabricated from not less than 0.0478-inch thick steel sheet; 0.0516-inch thick galvanized steel where used with galvanized steel frames.

E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A 153, Class C or D as applicable.

## 2.3 DOORS

A. Steel Doors: Provide 1-3/4-inch thick beveled edge doors of materials and ANSI/SDI 100 grades and models specified below, or as indicated on Drawings or schedules: (No square edge acceptable).

1. Interior Doors: Grade II, heavy-duty, Model 1, full flush design, minimum 16 gauge cold-rolled steel sheet faces.
2. Exterior Doors: Grade III, extra heavy-duty, Model 1, full flush design, minimum 16 gauge, A 60 galvanized steel.

## 2.4 FRAMES

A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 0.0478-inch thick cold-rolled steel sheet.

1. Fabricate frames with mitered or coped and continuously welded corners.
2. Form exterior and interior frames from 14 gauge galvanized steel.

B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.

C. Plaster Guards: Provide minimum 0.0179-inch thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

D. Grout: When required in masonry construction, as specified in Division 4 Section "Unit Masonry."

## 2.5 FABRICATION

A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.

1. Internal Construction: One of the following manufacturer's standard core materials according to SDI standards:

    a. Resin-impregnated paper honeycomb – at interior doors.
    b. Rigid polyurethane conforming to ASTM C 591 – at exterior doors.

2. Clearances: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between non-fire-rated pairs of doors. Not more than 3/4 inch at bottom.

    a. Fire Doors: Provide clearances according to NFPA 80.

B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel sheet.

C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Fabricate concealed vertical stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

E. Galvanized Steel Doors, Panels, and Frames: For the following locations, fabricate doors, panels, and frames from A 60 galvanized steel sheet according to SDI 112. Close top and bottom edges of doors flush as an integral part of door construction or by addition of minimum 0.0635-inch thick galvanized steel channels, with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration. Doors shall be vertically stiffened internally.

1. At exterior locations.

F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

G. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.

1. Unless otherwise indicated, provide thermal-rated assemblies with U-value rating of 0.09 Btu/sq. ft. x h x deg For better.

H. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI 107 and ANSI A115 Series specifications for door and frame preparation for hardware.

1. For concealed overhead door closers, provide space, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames, as applicable.

I. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

J. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

K. Glazing Stops: Minimum 0.0359-inch thick steel or 0.040-inch thick aluminum.

1. Provide screw-applied, removable, glazing beads on inside of glass,, and other panels in doors.

## 2.6 FINISHES, GENERAL

A. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for steel sheet finishes.

B. Apply primers and organic finishes to doors and frames after fabrication.

2.7 GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces with nonpetroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

B. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.

1. Shop Primer: Zinc-dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II. Apply shop primer that is **compatible with finish paint systems indicated**, and has capability to provide a sound foundation for field-applied topcoats.

2.8 STEEL SHEET FINISHES

A. Surface Preparation: Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).

B. Factory Priming for Field-Painted Finish: Apply shop primer that complies with ANSI A224.1 acceptance criteria, is **compatible with finish paint systems indicated**, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.

C. Site: Field Painting Spray finished prior to hardware installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
2. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
3. At existing concrete or masonry construction, install at least 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike

jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.

4. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel-stud partitions, attach wall anchors to studs with screws.
5. In in-place gypsum board partitions, install knock-down, slip-on, drywall frames.
6. Install fire-rated frames according to NFPA 80.

C. Door Installation: Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100.

1. Fire-Rated Doors: Install with clearances specified in NFPA 80.
2. Smoke-Control Doors: Comply with NFPA 105.

## 3.2 ADJUSTING AND CLEANING

A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 081113

# SECTION 081416 - FLUSH WOOD DOORS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Solid-core doors with plastic laminate as scheduled on the drawings.
2. Factory fitting flush wood doors to frames and factory machining for hardware.
3. Solid-core wood doors with factory finished wood veneer.

B. Related Sections include the following:

1. Division 8 Section "Glazing" for glass view panels in flush wood doors.

### 1.3 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.

C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:

1. Plastic-Laminate Door Faces: Show the full range of colors, textures, and patterns available.
2. Wood Stains: Show the full range of colors, textures, and patterns available.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edgings representing typical range of color and grain for each species of veneer and

solid lumber required. Finish sample with same materials proposed for factory-finished doors.
3. Plastic laminate, 6 inches (150 mm) square, for each color, texture, and pattern selected.
4. Corner sections of plastic-laminate-clad doors, approximately 8 by 10 inches (200 by 250 mm.
5. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

C. Forest Certification: Provide doors made from wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flush Wood Doors:

a. Algoma Hardwoods Inc.
b. Buell Door Company.
c. GRAHAM Manufacturing Corp.
d. Haley Brothers, Inc.
e. IPIK Door Company.
f. VT Industries Inc.
g. Weyerhaeuser Company.

2.2 DOOR CONSTRUCTION, GENERAL

A. Adhesives: Do not use adhesives containing urea formaldehyde.

B. Plastic-Laminate-Faced Doors:

1. Grade: Custom.
2. Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
3. Colors, Patterns, and Finishes: As selected by Architect from laminate manufacturer's full range of products.
4. Stiles: Plastic-laminate matching faces, applied before faces.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade LD-1.

a. Use particleboard made with binder containing no urea-formaldehyde resin.

2. Blocking: Provide wood blocking in particleboard-core doors as follows:

a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.

B. Interior Plastic-Laminate-Faced Doors:

1. Core: Particleboard.
2. Construction: Three plies with stiles and rails bonded to core, then entire unit abrasive planed before faces are applied.

C. Wood Solid-Core Doors:

1. Grade: Premium, with Grade A faces
2. Species: Birch
3. Cut: Rotary Cut
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
8. Exposed Vertical Edges: Applied wood-veneer edges of same species as faces and covering edges of faces
9. Core: Particleboard
10. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering
11. WDMA I.S.1-A Performance Grade: Extra Heavy Duty
12. Reference Opening Schedule for Fire Rating

D. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as follows:

    a. 5-inch (125-mm) top-rail blocking.
    b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
    c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
    d. 5-inch (125-mm) midrail blocking in doors indicated to have exit devices.

3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

## 2.4 LOUVERS AND LIGHT FRAMES

A. Metal Frames for Light Openings in Fire Doors: Manufacturer's standard frame formed of 0.0478-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory primed and approved for use in doors of fire rating indicated. Frames shall be thru-bolted and shall be equal to Anemostat #FGS-75.

## 2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Trim openings with moldings of material and profile indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

### 3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416


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# SECTION 084113 - ALUMINUM 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 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes the following:

1. Exterior entrance systems.
2. Exterior storefront systems.
3. Head & Sill Flashing
4. Door Hardware.
5. Sloped Atrium Window System

B. Related sections include the following:

1. Division 8 Section "Glazing."
2. Refer to Division 8 - Section 08700 - for Door Hardware for Aluminum Doors.

### 1.3 SYSTEM DESCRIPTION

A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:

1. Air infiltration and water penetration exceeding specified limits.
2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Glazing: Physically and thermally isolate glazing from framing members.

C. Thermally Broken Construction: Provide systems that isolate aluminum exposed to exterior from aluminum exposed to interior with a material of low thermal conductance.

D. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.

1. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch, whichever is smaller, unless otherwise indicated.
2. Static-Pressure Test Performance: Provide entrance and storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.

a. Test Pressure: 150 percent of inward and outward wind-load design pressures.

b. Duration: As required by design wind velocity; fastest 1 mile of wind for relevant exposure category.

E. Dead Loads: Provide entrance- and storefront-system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.

1. Provide a minimum 1/8-inch clearance between members and top of glazing or other fixed part immediately below.
2. Provide a minimum 1/16-inch clearance between members and operable windows and doors.

F. Live Loads: Provide entrance and storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.

G. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft.

H. Water Penetration: Provide entrance and storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. Water leakage is defined as follows:

1. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

I. Thermal Movements: Provide entrance and storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

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

J. Structural-Support Movement: Provide entrance and storefront systems that accommodate structural movements including, but not limited to, sway and deflection.

K. Condensation Resistance: Provide storefront systems with condensation resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.1.

L. Dimensional Tolerances: Provide entrance and storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

## 1.4 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.

1. For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.

C. Samples for Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

E. Sealant Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants; include joint sealant manufacturers' written interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

F. Field Test Reports: Indicate and interpret test results for compliance with storefront systems' performance requirements.

G. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of entrance and storefront systems with requirements based on comprehensive testing of current systems.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.

1. Engineering Responsibility: Prepare data for entrance and storefront systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type of entrance and storefront system through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of entrance and storefront systems and are based on the specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

1. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

## 1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating systems without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.7 WARRANTY

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements: Provide the system matching the existing FG-2000 Store Front. No substitutions.

1. Vistawall.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).

B. Steel Reinforcement: Complying with ASTM A 36 (ASTM A 36M) for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 (ASTM A 570M) for hot-rolled sheet and strip.

C. Glazing as specified in Division 8 Section "Glazing."

D. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

E. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

F. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

G. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 7 Section "Joint Sealants."

H. Mullions and Cover Plates: Shall be extruded aluminum of 6063-T5 alloy and temper of profile and imensions indicated on drawings. Mullions shall provide structural properties to resist wind pressure required by performance criteria and standards.

I. Thermal Barrier: 1 /4" separation consisting of a two part chemically curing, high density, polyurethane mechanically and adhesively joined to aluminum window sections, or the Manufacturer's standard.

J. Flashing: Provide Break metal to match finish of window for silhand head. Provide intrigal end dam on sill flashings.

2.3 COMPONENTS

A. Doors: Provide manufacturer's standard 1-3/4-inch thick glazed doors with minimum 0.125-inch thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.

1. Manufacturer and system: Medium style door (See #3 Below).
2. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
3. Stile Design: 4" sides, 3/12 top and 10 ½ " bottom rail to match existing.

B. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide 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. Reinforce members as required to retain fastener threads.
2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

E. Concealed Flashing: Dead-soft, 0.018-inch thick stainless steel, complying with ASTM A 666, of type selected by manufacturer for compatibility with system at Head and Sills.

F. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:

Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing complying with AAMA 701 requirements.

2.4 HARDWARE

A. General: Refer to Section 087100 “Door Hardware” for hardware this section. Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for entrances indicated. Finish exposed parts to match door finish, unless otherwise indicated.

B. Continuous Hinge: Pivots top and bottom and intermediate. Finish to match existing.

C. Closers, General: Comply with manufacturer's recommendations for closer size, depending on door size, exposure to weather, and anticipated frequency of use.

1. Closing Cycle: Comply with requirements of authorities having jurisdiction or the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," whichever are more stringent.
2. Opening Force: Comply with the following maximum opening-force requirements for locations indicated:

a. Exterior Doors: 15 lbf.

D. Surface-Mounted Overhead Closers: ANSI/BHMA A156.4, Grade 1. Provide cover and the following:

1. Mounting: Parallel arm. As scheduled.
2. Back Check: Adjustable.
3. LCN – no substitutions.

E. Door Stops: See Hardware Schedule – Section 087100

F. Cylinders: As specified in Division 8 Section "Door Hardware."

G. Mortise Cylinders: MSU’s standard, 6-pin, mortised cylinders complying with ANSI/BHMA A156.5, Grade 1 requirements.

1. Provide outside mortise cylinders.
2. Provide inside and outside mortise cylinders.

H. Rim type Exit Devices: Von-Duprin Panic Devices – no substitutions. Release latch by pushing crossrail or when locked down (dogged) by lock cylinder or retracting screws beneath housing.

I. Pull Handles: Aluminum pull handles to match existing.

J. Thresholds: At exterior doors, provide manufacturer's standard threshold with cutouts coordinated for operating hardware, with anchors and jamb clips, and not more than 1/2-inch high, with beveled edges providing a floor level change with a slope of not more than 1:2, and in the following material:

1. Material: Aluminum, Dark Bronze.

K. Weather Sweeps: Manufacturer's standard weather sweep for application to exterior door bottoms and with concealed fasteners on mounting strips.

2.5 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners and anchor and connection devices.

D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

G. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

H. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.

1. Exterior Doors: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.

2.6 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. Finish: AAMA 611, Class 1, Dark Bronze to match existing.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. 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 and condensation and moisture occurring or migrating within the system to the exterior.

D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 7 Section "Joint Sealants."

E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.

1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.

G. Install glazing to comply with requirements of Division 8 Section "Glazing," unless otherwise indicated.

1. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
2. Install structural silicone sealant according to sealant manufacturer's written instructions.
3. Mechanically fasten glazing in place until structural sealant is cured.
4. Remove excess sealant from component surfaces before sealant has cured.

H. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.

I. Install perimeter sealant to comply with requirements of Division 7 Section "Joint Sealants," unless otherwise indicated.

J. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

## 3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner at his option may engage a qualified independent testing agency to perform field quality-control testing indicated.

B. Repair or remove and replace Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

## 3.4 ADJUSTING AND CLEANING

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.

B. Remove excess sealant and glazing compounds, and dirt from surfaces.

## 3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 084113


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# SECTION 084413 GLAZED ALUMINUM CURTAIN WALLS

## 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: Kawneer Architectural Aluminum Curtain Wall Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of curtain wall units.
   1. Types of Kawneer Curtain Wall and Glazed Assemblies include:
      a. 1600UT System™1 Curtain Wall:
         1) 1" (25.4 mm) double glazed insulating glass: 2-1/2" x 6" outside glazed pressure plate format.

B. Related Sections:
   1. 072700 “Air Barriers”
   2. 079200 “Joint Sealants”
   3. 084113 “Aluminum-Framed Entrances and Storefronts”
   4. 088000 “Glazing”

### 1.3 Definitions

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufactures Association (AAMA) – AAMA Glossary (AAMA AG).

### 1.4 Performance Requirements

A. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Loosening or weakening of fasteners, attachments, and other components.
      d. Failure of operating units.

B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind loads: Provide Curtain Wall system; include anchorage, capable of withstanding wind load design pressures based on the IBC Building Code; 2015 Edition.

D. Structural-Test Performance: Test according to ASTM E 330 and TAS 202 as follows:
   1. When tested at positive and negative wind load design pressures, assemblies do not evidence deflection exceeding L/175 of clear span.
   2. A static air design load of 40 psf (1915 Pa) shall be applied in the positive and negative direction.
      a. When tested at 150% of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2% percent of clear span.
      b. Minimum test duration according to ASTM E 330 is 10 seconds.

E. Deflection of Framing Members: At design wind pressure, as follows:
   1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 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. Limit deflection of clear span of framing members to L/175 for spans less than or equal to 13'-6" (4.11 meters) and L/240 + ¼" for spans greater than 13'-6" (4.11 meters).
   2. Deflection Parallel to Glazing Plane: Limited to [L/360 of clear span or 1/8 inch, whichever is smaller] [amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch
      a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
   3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.

F. Seismic Story Drift: Accommodate design displacement of adjacent stories indicated.
   4. Design Displacement: Shall not exceed 1% of story height.
   5. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

G. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 and TAS 202 at 15 psf (720 Pa).

H. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 15 psf (720 Pa).
   6. Maximum Water Leakage: [According to AAMA 501.1] [No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation]. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.

I. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
   7. Temperature Change (Range): 0 deg F (-18 deg C); 180 deg F (82 deg C).
   8. Test Interior Ambient-Air Temperature: [75 deg F (24 deg C)] .
   9. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5 for a minimum 3 cycles.

J. Energy Performance: Glazed aluminum curtain walls shall be tested in accordance with NFRC and AAMA Standards.
   1. Thermal Transmittance (U-factor):
      a. 1600UT System™1 Curtain Wall:
         1) Glass and framing areas shall have U-factor of no greater than 0.33 with 1" (25.4 mm) High Performance (HP) Glass as determined according to AAMA 1503 or Project specific ( ) BTU/Hr/Ft$^2$/°F per AAMA 507 or ( ) BTU/Hr/Ft$^2$/°F per NFRC 100.
   2. Solar Heat Gain Coefficient: Glass and framing areas shall have a solar heat gain coefficient of no greater than [0.35] [0.40] [0.45] <Insert value> as determined according to NFRC 200.
   3. Air Leakage: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq.ft. (0.31 l/s.m$^2$) of fixed wall area as determined according to ASTM E 283 and TAS 202 at a minimum static-air-pressure differential of 6.2 psf (300 Pa).
   4. Condensation Resistance: When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
      a. 1600UT System™1 Curtain Wall:
         1) $CRF_{glass}$ (1" [25.4 mm] Double Glazed HP) = 76, $CRF_{frame}$ =79
   5. Temperature Index (I): when tested to CSA-A440-00, the Temperature Index shall not be less than:
      a. 1600UT System™1 Curtain Wall with aluminum pressure plate:

1) $I_{glass}$ (1" [25.4 mm] Double Glazed HP) = 67, $I_{frame}$ =71

K. Sound Transmission: Provide glazed aluminum curtain walls with fixed glazing and framing areas having the following sound-transmission characteristics:
   1. 1600UT System™1 Curtain Wall:
      a. STC-31 or OITC-25 when tested for laboratory sound transmission loss according to ASTM E 90 and ASTM E 1425, and based on 1" (25.4 mm) double insulating glass (1/4", 1/2" AS, 1/4")

1.5 Submittals

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.

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. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed curtain wall systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:
   1. Joinery
   2. Glazing

1.6 Quality Assurance

A. Installer Qualifications: Installer who has had successful experience with installation of the same or similar systems required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed performance requirements.

C. Source Limitations: Obtain aluminum curtain wall system through one source from a single manufacturer.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not modify 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.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for type(s) of curtain wall elevation(s) indicated, in location(s) shown on Drawings.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination”.

1.7 Project Conditions

A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 Warranty

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
   1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Basis-of-Design Product:
   1. Kawneer Company Inc.
   2. 1600UT System™1 Curtain Wall
   3. Frame depth options: 6" (152.4 mm) with 1" Double Glazed Insulating Glass
   4. Tested to AAMA 501-05 and TAS 202

B. Substitutions: Refer to Substitutions Section for procedures and submission requirements.
   1. Post-Contract Substitutions: Submit written request in order to avoid curtain wall installation and construction delays.
   2. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
   3. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for curtain wall system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum curtain walls for a period of not less than ten (10) years. (Company Name).
   4. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
   5. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

C. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

2.2 Materials

A. Aluminum Extrusions: Alloy and temper recommended by glazed aluminum curtain wall manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Aluminum sheet alloy: Shall meet the requirements of ASTM B209.

C. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.

D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Pressure Plate: Pressure plate shall be either aluminum or fiberglass and fastened to the mullion with stainless steel screws. Fiberglass pressure plate shall be tested to ASTM D638, D790, D695, D953, D3846.

F. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

G. Sealant: For sealants required within fabricated curtain wall system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

H. Thermal Barrier: Thermal barrier consists of 1" (25.4 mm) separation between the interior and exterior metal members in a typical condition. Thermal barrier assembly shall be tested to the thermal cycling requirements of ASTM E2692 and show no sign of degradation following the test.

I. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of glazed curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 Curtain Wall Framing

A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Glazing System: 4-sided captured or 2-sided SSG.
   2. Glazing Plane: Front.

B. Glass: 1" for Spandrel applications.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Framing Sealants: Shall be suitable for glazed aluminum curtain wall as recommended by sealant manufacturer.

E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.

F. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

G. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

H. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle curtain wall material and components to avoid damage. Protect curtain wall material against damage from elements, construction activities, and other hazards before, during and after installation.

2.4 Glazing

A. Glazing: Comply with Division 08 Section “Glazing”. Following glazing options are available.
   1. 1600UT System™1 Curtain Wall: Outside glazed pressure plate format with 1" double glazed triple glazed insulating glass. The tint of glazing shall be selected from a full range of available manufacturers colors, from light/clear to dark bronze.
   2. 1600UT System™2 Curtain Wall: Outside glazed structural silicone glazed (SSG) format with 1" (25.4 mm) double glazed and 1-3/4" (44.4 mm) triple glazed insulating glass.

B. Glazing Gaskets: Gaskets to meet the requirements of ASTM C864.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: As recommended by manufacturer for joint type.

2.5 Accessory Materials

A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.6 Fabrication

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints.
   3. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from exterior.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   7. Internal weeping system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
   8. Double seal design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

C. Curtain Wall Framing: Fabricate components for assembly using shear block system following manufacturer's standard installation instructions.

D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 Aluminum Finishes

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
   1. Kawneer Permanodic™ AA-M10C21A44 / AA-M45C22A44, AAMA 611, Architectural Class I Color Anodic Coating Color; Dark Bronze.

PART 3 - EXECUTION

3.1 Examination

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure non-movement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
   7. 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 by applying sealant or tape or 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 glazed aluminum curtain wall to exterior.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

G. Install glazing as specified in Division 08 Section “Glazing.”

3.3 Field Quality Control

A. Field Tests: Architect shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer’s representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.
   1. Testing: Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.
      a. Air Leakage Tests: Conduct tests in accordance with ASTM E 783. Allowable air leakage shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 $cfm/ft^2$, whichever is greater.
      b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 psf (383 Pa).

B. Manufacturer’s Field Services: Upon Owner’s written request, provide periodic site visit by manufacturer’s field service representative.

3.4 Adjusting, Cleaning and Protection

A. Protection: Protect installed product’s finish surfaces from damage during construction. Protect aluminum curtain wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

B. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer’s instructions prior to owner’s acceptance. Remove construction debris from project site and legally dispose of debris.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 084413


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# SECTION 087100 - DOOR HARDWARE

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 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.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: For power, signal, and control wiring and including the following:

a. Details of interface of electrified door hardware and building safety and security systems.
b. Schematic diagram of systems that interface with electrified door hardware.
c. Point-to-point wiring.
d. Risers.
e. Elevations doors controlled by electrified door hardware.

2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate

submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.

b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.

c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.

d. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.
2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
5) Fastenings and other pertinent information.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

## 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For electrified door hardware, from the manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Warranty: Special warranty specified in this Section.

## 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. 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 follows:

1. For door hardware, an Architectural Hardware Consultant (AHC).

C. Source Limitations: Obtain each type of door hardware from a single manufacturer as much as possible.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. 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.

H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and Texas Accessibility Guidelines.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.

b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

I. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include supplier's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

J. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys and permanent cores to Owner by registered mail overnight package service, or in person.

## 1.8 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

## 1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware, caused by product defects.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

a. Exit Devices: Three years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

## 1.10 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products only.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required no substitutions. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. McKinney; an ASSA ABLOY Group Company.

2.3 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. Mortise Locks: Minimum 3/4-inch latchbolt throw.
2. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches, unless otherwise indicated.

D. Lock Trim:

1. Description: As indicated on Drawings.
2. Levers: Wrought.
3. Full Plate Escutcheons: Wrought.
4. Dummy Trim: Match lock trim and escutcheons.
5. Operating Device: Lever with Full Plate 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.

F. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.

G. Push-Pull Latches: Bored, BHMA A156.2; Series 4000 Mortise, BHMA A156.13; Grade 1; with paddle handles that retract latchbolt; capable of being mounted vertically or horizontally.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.

## 2.4 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. IVES Hardware; an Ingersoll-Rand company.

## 2.5 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Von Duprin; an Ingersoll-Rand company.

## 2.6 LOCK CYLINDERS

A. Provide to all locking devices 6 pin interchangeable core.

B. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturer: Same manufacturer as for locking devices.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the:

   a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.

C. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.

D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

## 2.7 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.
2. Existing System:
   a. Master key or grand master key locks to Owner's existing system. Verify and insure to match existing.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

   a. Notation: "DO NOT DUPLICATE.

2. Quantity: In addition to one extra key blank for each lock, provide the following:

   a. Cylinder Change Keys: Three.
   b. Master Keys: Five.
   c. Grand Master Keys: Five.
   d. Great-Grand Master Keys: Five.

## 2.8 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 recommendations 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.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. LCN Closers; an Ingersoll-Rand company.

## 2.9 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; Stainless Steel base metal.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. National Guard Products (NGP).

2.10 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Glynn-Johnson; an Ingersoll-Rand company.

2.11 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. National Guard Products.

2.12 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. National Guard Products.

2.13 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick, finish as indicated; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. IVES Hardware; an Ingersoll-Rand company.

2.14 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

    a. Wood or Machine Screws: For the following:

        1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
        2) Strike plates to frames.
        3) Closers to doors and frames.

    b. Steel Through Bolts: For the following unless door blocking is provided:

        1) Surface hinges to doors.
        2) Closers to doors and frames.
        3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

## 2.15 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

### 3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

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. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. 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. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Furnish permanent cores to Owner for installation.

F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "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.

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.

## 3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

## 3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DOOR HARDWARE SCHEDULE

NOTE: INSURE HARDWARE FINISH FOR EACH BUILIDNG MATCHES EXISTING BUILDING AND MATCHES WITHIN HARDWARE HEADING:

LEGEND

CR = CORBIN RUSSWIN
LCN = LCN
M = MCKINNEY
NGP = NATIONAL GUARD PRODUCTS
T = TRIMCO
P = PIMKO
VD = VON DUPRIN

## BOLIN SCIENCE HALL

**BHW – 1** FINISH

**DOOR # B1**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99 – 4 ½ X 4 ½ | M | 626 |
| 1 | EXIT DEVICE | 98EO-F | VD | 710 |
| 1 | CLOSER | 4011 | LCN | AL |
| 1 | DOOR BOTTOM | 1015V | NGP | AL |
| 1 | RAIN DRIP | 16SS | NGP | AL |
| 1 | THRESHOLD | 896 | NGP | AL |
| 1 | SILICONE SMOKE SEAL | 5050 | NGP | B |
| 1 | STOP | 1258 MS X ES W/RISER 1257 | T | AL |

**BHW – 2**

**STAIR DOORS # B2, B10, B11**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99 – 4 ½ X 4 ½ | M | 626 |
| 1 | EXIT DEVISE | 98L – BE – F | VD | 710 |
| 1 | THRESHOLD | 896 | NGP | AL |
| 1 | CLOSER | 4011 | LCN | AL |
| 1 | STOP | 1278CX | T | AL |

**BOLIN SCIENCE HALL CONT'D . . .**

**BHW – 3**

**STORAGE DOORS # B9, B13, B15, B18, B19, B20**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99- 4 ½ X 4 ½ | M | 626 |
| 1 | MORTISE LOCK | ML2224 X LWM | CR | 626 |
| 1 | CLOSER | 4020 X 180 DEGREE | LCN | A |
| 1 | STOP | 1278CX | T | AL |
| 1 | SILICONE SMOKE SEAL | 5050 | NGP | B |

**BHW – 4**

**CLASSROOM DOORS # B14, B16, B17**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99- 4 ½ X 4 ½ | M | 626 |
| 1 | MORTISE LOCK | ML2224 X LWM | CR | 626 |
| 1 | CLOSER | 4011 * | LCN | AL |
| 1 | SMOKE SEAL | 5050 | NGP | B |
| 1 | STOP | 1278CX | T | 626 |

*** USE CLOSER 4020 X 180 DEGREES AT DOOR B14**

**BHW – 5**

**DOORS # B5, B12**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99 – 4 ½ X 4 ½ | M | 626 |
| 1 | EXIT DEVISE | 98L – BE – F | VD | 710 |
| 1 | CLOSER | 4011 | LCN | AL |
| 1 | STOP | 1278CX | T | AL |

**BHW – 6**

**PAIR DOORS #' B3, B4, B6, B7, B8, B21**

HARDWARE PER LEAF

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99 – 4 ½ X 4 ½ | M | 626 |
| 1 | HEX KEYED REMOVEABLE MULL | 9954 | VO | USP |
| 1 | EXIT DEVICE | 98L-BE-F | VD | 710 |
| 1 | CLOSER | 4020 X 180 DEGREES | LCN | AL |
| 1 | STOP | 1278CX | T | 626 |
| 1 | SMOKE SEAL | 5050 | NGP | B |

## FERGUSON BUILDING

**FHW – 1**

**DOORS # F1, F2**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99 – 4 ½ X 4 ½ | M | 613 |
| 1 | EXIT DEVICE | 98EO-F | VD | 713 |
| 1 | CLOSER | 4011 | LCN | DKBRZ |
| 1 | DOOR BOTTOM | 1015V | NGP | BR-DKB |
| 1 | RAIN DRIP | 16SS | NGP | BR-DKB |
| 1 | THRESHOLD | 896 | NGP | BR-DKB |
| 1 | SILICONE SMOKE SEAL | 5050 | NGP | B |
| 1 | STOP | 1258 MS X ES W/RISER 1257 | T | 613 |

**FHW – 2**

**DOORS # F3, F4**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTT | MPB99 – 4 ½ X 4 ½ | M | 613 |
| 1 | MORTISE LOCK | 2269 X LWM | CR | 613 |
| 1 | CLOSER | 4011 | LCN | DKBRZ |
| 1 | STOP | 1278CX | T | 613 |
| 1 | SILICONE SMOKE SEAL | 5050 | NGP | B |

## FAIN FINE ARTS BUILDING

**FFHW – 1**

**EXTERIOR EGRESS SINGLE**

**DOORS # FF1, FF2, FF9, FF10, F13**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99 – 4 ½ X 4 ½ | M | 613 |
| 1 | EXIT DEVICE | 98EO-F | VD | 713 |
| 1 | CLOSER | 4011 | LCN | DKBRZ |
| 1 | DOOR BOTTOM | 1015V | NGP | BR-DKB |
| 1 | RAIN DRIP | 16SS | NGP | BR-DKB |
| 1 | THRESHOLD | 896 | NGP | BR-DKB |
| 1 | SILICONE SMOKE SEAL | 5050 | NGP | B |
| 1 | STOP | 1258 MS X ES W/RISER 1257 | T | 613 |

**FAIN FINE ARTS CONT'D . . .**

**FFHW – 2**

**DOOR # FF3, FF14**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99 – 4 ½ X 4 ½ | M | 613 |
| 1 | EXIT DEVISE | 98L – BE – F | VD | 713 |
| 1 | THRESHOLD | 896 | NGP | BR-DKB |
| 1 | CLOSER | 4011 | LCN | DKBRZ |
| 1 | STOP | 1278CX | T | 613 |

**FFWH – 3**

**STORAGE DOORS # FF4, FF7, FF8, FF15, FF17, FF20**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99- 4 ½ X 4 ½ | M | 613 |
| 1 | MORTISE LOCK | ML2224 X LWM | CR | 613 |
| 1 | CLOSER | 4020 X 180 DEGREE | LCN | DKBRZ |
| 1 | STOP | 1278CX | T | 613 |
| 1 | SILICONE SMOKE SEAL | 5050 | NGP | B |

**FFHW – 4**

**RESTROOM DOORS # FF5, FF6, FF11, FF12;**
**DRESSING ROOM DOORS # FF16, FF18**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99 – 4 ½ X 4 ½ | M | 613 |
| 1 | MORTISE PASSAGE | 2210 X LWM | CR | 613 |
| 1 | CLOSER | 4020 X 180 DEGREES | LCN | DKBRZ |
| 1 | STOP | 1278CX | T | 613 |
| 1 | SILICONE SMOKE SEAL | 5050 | NGP | B |

**FFHW – 5**

**OFFICE DOOR # FF19**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99- 4 ½ X 4 ½ | M | 613 |
| 1 | MORTISE LOCK | ML2224 X LWM | CR | 613 |
| 1 | CLOSER | 4011 W/4020 @ 14 | LCN | DKBRZ |
| 1 | SILICONE SMOKE SEAL | 5050 | NGP | B |
| 1 | STOP | 1278CX | T | 613 |

## HARDIN ADMINISTRATION BUILDILNG

**NOTE:** THE EXISTING DOORS ARE HISTORICAL IN NATURE. THE INTENT IS TO MAINTAIN THE EXISTING DOORS AND MODIFY AND/OR PROVIDE NEW HARDWARE TO MAKE OPENINGS ACCESSIBLE AND MAKE EXITS COMPLIANT WITH STATE MARSHALL REQUIREMENTS.

**H-HW-1**

**DOOR # H1** **HM X HM**

PAIR OF 2' – 6" LEAFS WITH A REMOVABLE MULLION. REMOVE MULLION AND PROVIDE PANIC DEVICES TO ALL BOTH LEAFS TO OPERATE AS ONE OPENING. REMOVE EXISTING PANIC AND THUMB LATCH AND PROVIDE METAL COVER PLATES.

HARDWARE PER LEAF:

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB68 – 5" X 4 ½" | M | 613 |
| 1 | THRESHOLD | REUSE EXISTING | | |
| 1 | PANIC DEVICE | 9827-LBR-994L-03 | VD | 613 |
| 1 | OPERATOR | 4640 | LCN | 613 |

NOTE: COMPLETE WITH CONTOLER, INTERIOR & EXTERIOR ACUATOR; LOW VOLTAGE WIRING AND SEQUENCER FOR A FULLY FUNCTIONING PAIR OF DOORS.

**H-HW-2**

**DOORS # H2, H7, H8** **WOOD X WOOD**
**PER LEAF**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB68 – 4' X 4" | M | 613 |
| 1 | PANIC DEVICE | 9827-LBR-994L-03 | VD | 613 |
| 1 | OPERATOR | 4640 | LCN | 613 |
| 2 | PUSH PLATES TO COVER HARDWARE PREP | | T | 613 |

NOTE: COMPLETE WITH CONTOLER, INTERIOR & EXTERIOR ACUATOR; LOW VOLTAGE WIRING AND SEQUENCER FOR A FULLY FUNCTIONING PAIR OF DOORS. REMOVE WOOD ASTRAGAL FROM DOOR. REMOVE CYLINERAL LOCKS AND FLUSH BOLTS. FILL PREPS WITH WOOD TO MATCH DOOR.

**H-HW-3**

**DRESSING ROOMS – PASSAGE**
**DOORS # H3, H4, H23, H24**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99 – 4 ½" X 4 ½" | M | 613 |
| 1 | MORTISE PASSAGE | 2210XLWM | CR | 613 |
| 1 | CLOSER | 4011 X 90 DEGREES | LCN | DKBR2 |
| 1 | STOP | 1278CX | T | 613 |
| 1 | SILICONE SMOKE SEAL | 5050 | NGP | B |

**H-HW-4**

**TOILET ROOM – PRIVACY**
**DOORS # H5, H6, H16, H23**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99 – 4 ½' X 4 ½" | M | 613 |
| 1 | MORTISE LOCK | ML 2269 X LWM | CR | 613 |
| 1 | CLOSER | 4011 | LCN | DKBRZ |
| 1 | STOP | 1278CX | T | 613 |

**H-HW-5**

**STORAGE DOOR #H21**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB99 - 4 ½" X 4 ½" | M | 613 |
| 1 | MORTISE LOCK | ML2224XLWM | CR | 613 |
| 1 | STOP | 1278CX | T | 613 |
| 1 | CLOSER | 4011 – 90 DEGREES | LCN | DKBRZ |
| 1 | SILICONE SMOKE SEAL | 5050 | NGP | B |

**H-HW-6**

**STAGE ACESS DOOR #22 – PAIR**

| | | | | |
|---|---|---|---|---|
| 3 | PAIR BUTTS | MPB99 - 4 ½" X 4 ½" | M | 613 |
| 2 | STOPS | 1278CX | T | 613 |
| 1 | FLUSH BOLT | 3913 W/3910 STRIKE | T | 613 |
| 1 | MORTISE LOCK | ML2269 X LWM | CR | 613 |

**H-HW-7**

PAIR OF 2' – 6" LEAFS WITH EXISTING DEADBOLT, FLUSH BOLTS AND PUSH PULL CLOSURE ON EACH DOOR. REMOVE EXISTING HARDWARE AND PROVIDE METAL COVER PLATES TO CONCEAL ANY UN-USED ORIGINAL HARDWARE LOCATIONS.

**HARDWARE PER LEAF;**
**DOORS #H11, H13, H18, H20**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB68 – 5" X 4 ½" | M | 613 |
| 1 | PANIC DEVISE | 9827-LBR-994L-03 | VD | 613 |
| 1 | OPERATOR | 4640 | LCN | 613 |
| 1 | ASTRAGAL | 139SPDKB | NGP | DKB |
| 1 | WEATHER STRIP | PK33 | P | B |
| 1 | COORDINATOR | 9303 | T | 613 |

NOTE: (COMPLETE WITH CONTOLER, INTERIOR & EXTERIOR ACUATOR; LOW VOLTAGE WIRING AND SEQUENCER FOR A FULLY FUNCTIONING PAIR OF DOORS).

**H-HW-8**

**DOORS # H12, H14, H19**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB68 – 5” X 4 ½” | M | 613 |
| 1 | PANIC DEVISE | 9827-LBR-994L-03 | VD | 613 |
| 1 | ASTRAGAL | 139SPDKB | NGP | DKB |
| 1 | WEATHER STRIP | PK33 | P | B |
| 1 | COORDINATOR | 9303 | T | 613 |

**H-HW-9**

PAIR OF 2’ – 6” LEAFS WITH EXISTING PUSH – PULL CLOSERS, FLUSH BOLT ON SET. REMOVE EXISTING HARDWARE AND PROVIDE METAL COVER PLATES TO CONCEAL ANY UN-USED ORIGINAL HARDWARE LOCATION.

**HARDWEAR PER LEAF**
**DOORS # H15, H17**

| | | | | |
|---|---|---|---|---|
| 1 ½ | PAIR BUTTS | MPB68 – 5” X 4 ½” | M | 613 |
| 1 | PANIC DEVICE | 9827 LBR-697DT-02 | VD | 613 |
| 1 | OPERATOR | 4640 | LCN | 613 |
| 1 | ASTRAGAL | 139SPDKB | NGP | DKB |
| 1 | WEATHER STRIP | PK33 | P | B |
| 1 | COORDINATOR | 9303 | T | 613 |

NOTE: (COMPLETE WITH CONTOLER, INTERIOR & EXTERIOR ACUATOR; LOW VOLTAGE WIRING AND SEQUENCER FOR A FULLY FUNCTIONING PAIR OF DOORS).

END OF SECTION 087100


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ARCHITECTS PROGRAMMERS PLANNERS

# SECTION 088000 - GLAZING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Doors.
2. Interior borrowed lites.
3. Insulating Glass
4. Tempered Float – Clear
5. Fire Rated Glass

### 1.3 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch square Samples for glass.

1. Each color of tinted float glass.
2. Insulating Glass
3. Abrasion-Resistant Polycarbonate Glazing
4. Fire Rated Glass

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations for Clear Glass: Obtain clear float glass from one primary-glass manufacturer.

C. Source Limitations for Coated Glass: Obtain coated glass from one manufacturer for each type of coating and each type and class of float glass indicated.

D. Source Limitations for Insulating Glass: Obtain insulating-glass units from one manufacturer using the same type of glass and other components for each type of unit indicated.

E. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg .

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in schedules at the end of Part 3.

2.2 TYPE GL4 FROM SHW - TEMPERED

A. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.

1. ¼" thick clear.

2.3 GL1 – INSULATED GLASS FROM SHW

A. Insulating-Glass Units: Pre-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article. Where glass of this designation is indicated, provide insulating-glass units complying with the following:

1. Overall Unit Thickness and Thickness of Each Lite: 1", each lite ¼"
2. Interspace Content: Air ½" Thick.
3. Indoor Lite: Type I transparent glass, flat Class 1 clear float glass.
4. Outdoor Lite: Transparent glass, flat float glass. - Tinted
   a. Class 2 tinted, heat absorbing, and light reducing.
      1) Tint Color: Gray – Architect will select from mfg. Standards.
5. Visible Light Transmittance: 39%
6. Winter Daytime U-Value: 0.48
7. Summer Nighttime U-Value: 0.57
8. Solar Heat Gain Coefficient: 0.45

B. Sealing System: Dual seal, with primary and secondary sealants as follows:

1. Manufacturer's standard sealants.

2.4 TYPE GL3 - CLEAR FLOAT GLASS

A. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.

1. ¼" Clear.

2.5 TYPE GL4 -TEMPERED FLOAT – CLEAR

A. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.

B. Outdoor Lite: Type I transparent glass, flat float glass. - Tinted

1. Class 2 tinted, heat absorbing, and light reducing.
   a. Tint Color: Clear.

1. Thickness: ¼"

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.09 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

C. Grind smooth and polish exposed glass edges.

2.10 GLAZING GASKETS

A. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glazing, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.5 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glazing from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glazing, remove them immediately as recommended by glazing manufacturer.

C. Examine glazing surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glazing manufacturer.

D. Remove and replace glazing that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glazing on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glazing as recommended by glazing manufacturer.

END OF SECTION 08800

# SECTION 092550 - GYPSUM BOARD ASSEMBLIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Bearing and Nonload-bearing steel framing members for gypsum board assemblies.
2. Gypsum board assemblies attached to steel framing.
3. Vandal Resistant Gypsum Board assemblies
4. Water resistant gypsum board ceiling assemblies – Cementious Board.

### 1.3 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

### 1.4 ASSEMBLY PERFORMANCE REQUIREMENTS

A. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

B. Fire Resistance: Provide gypsum board assemblies with fire-resistance ratings indicated.

### 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 each type of product specified.

C. Shop Drawings showing locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

D. Product certificates signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.

### 1.6 QUALITY ASSURANCE

A. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.

B. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

C. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

D. Fire-Test-Response Characteristics: Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:
   1. Fire-Resistance Ratings: As indicated by GA File Numbers in GA-600 "Fire Resistance Design Manual" or design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
   3. Deflection and Firestop Track: Top runner provided in fire-resistance-rated assemblies indicated is labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

1.8 PROJECT CONDITIONS

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.

B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours before application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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: NOTE: Developed Studs are not acceptable.

   1. Steel Framing and Furring:

      a. Clark Steel Framing, Inc.
      b. Dietrich Industries, Inc.

c. National Gypsum Co.; Gold Bond Building Products Division.

2. Grid Suspension Assemblies:

a. Armstrong World Industries, Inc.
b. Chicago Metallic Corp.
c. USG Interiors, Inc.

3. Gypsum Board and Related Products:

a. Domtar Gypsum.
b. Georgia-Pacific Corp.
c. National Gypsum Co.; Gold Bond Building Products Division.
d. United States Gypsum Co.

B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work where proprietary gypsum wallboard is indicated include, but are not limited to, the following:

1. Fire-Shield G; National Gypsum Co.; Gold Bond Building Products Division.
2. SHEETROCK Brand Gypsum Panels, FIRECODE Core; United States Gypsum Co.
3. SHEETROCK Brand Gypsum Panels, Exterior Gypsum Ceiling Board, United States Gypsum Co.
4. HI-IMPACT Brand XP Gypsum Wallboard, National Gypsum Co.; Gold Bond Building Products Division.

## 2.2 STEEL FRAMING FOR WALLS AND PARTITIONS

A. General: Provide steel framing members complying with the following requirements:

1. Protective Coating: ASTM A 653, G 40 (ASTM A 653M, Z 90) hot-dip galvanized coating.

B. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch-wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:

1. Thickness: 0.0179 inch, unless otherwise indicated. At stud heights exceeding 13', provide stud thickness of 0.0312 inch.
   a.) Stud thickness or spacing shall not be less than recommended by the manufacturer – for typical applications of heights required.
2. Depth: As indicated.

C. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

## 2.3 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Components, General: Comply with ASTM C 754 for conditions indicated.

B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch diameter wire.

C. Hanger Attachments to Concrete: As follows:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.

a. Type: Postinstalled, expansion anchor

D. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

E. Hangers: As follows:
2. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
2. Rod Hangers: ASTM A 510, mild carbon steel.
a. Diameter: 1/4-inch
b. Protective Coating: ASTM A 153/A 153M, hot-dip galvanized
3. Flat Hangers: Commercial-steel sheet, ASTM A 653/A 653M, G40, hot-dip galvanized
a. Size: 1 by 3/16 inch by length indicated
4. Angle Hangers: ASTM A 653/A 653M, G60 hot-dip galvanized commercial-steel sheet.
a. Minimum Base Metal Thickness: 0.0312 inch.
b. Size: 1-5/8 by 1-5/8 inches

F. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch wide flange, with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.

4. Depth: 1-1/2 inches

G. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.

1. Cold Rolled Z Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch wide flange, 3/4 inch deep.
2. Steel Studs: ASTM C 645.

a. Minimum Base Metal Thickness: 0.0312 inch
b. Depth: 1-5/8 inches

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
a. Minimum Base Metal Thickness: 0.0312 inch

## 2.4 GYPSUM BOARD PRODUCTS

A. General: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.

1. Widths: Provide gypsum board in widths of 48 inches (1219 mm).

B. Gypsum Wallboard: ASTM C 36 and as follows:

1. Type: Type X (fire-resistant).
2. Edges: Tapered.
3. Thickness: 5/8 inch unless otherwise indicated on the drawings.

C. Exterior Gypsum Soffit Board: ASTM C 931, with manufacturer's standard edges, of type and thickness indicated below:

1. Type: DensGlass Soffit Boards.
2. Thickness: ½" , unless otherwise indicated on the drawings.

D. Water Resistant Green Board – Cementious
1. Type: Tile Board.
2. 5/8" thick, unless otherwise indicated.
3. Provide at all wall and ceiling surfaces at the following areas: Toilet, Janitor, and areas and as noted on the "Finish Schedule".

E. Hi-Impact Gypsum Wallboard:

1. Type: Type X (vandal-resistant).
2. Edges: Tapered.
3. Thickness: 5/8 inch unless otherwise indicated on the drawings.
4. Location: At all areas except those with ceramic wall tile finish – ref. Finish Schedule for locations of ceramic tile.

2.5 TRIM ACCESSORIES

A. Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:

1. Material: Formed metal or plastic, with metal complying with the following requirement:

a. Steel sheet zinc coated by hot-dip process or rolled zinc.

2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:

a. Cornerbead on outside corners, unless otherwise indicated.
b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim, unless otherwise indicated.
c. L-bead with face flange only; face flange formed to receive joint compound
d. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
a. One-piece control joint formed with "V" slot and removable strip covering slot opening.
b. U-Bead: J-shaped; exposed short flange does not receive joint compound;
c. Expansion (Control) Joint: Use where indicated.

B. Accessory for Curved Edges: Cornerbead formed of metal, plastic, or metal combined with plastic, with either notched or flexible flanges that are bendable to curvature radius.

C. Accessories for Exterior Installations: Cornerbead, edge trim, and control joints formed from steel sheet zinc coated by hot-dip process or rolled zinc complying with ASTM C 1047, in shapes indicated below by reference to Fig. 1 designations in ASTM C 1047.

1. Cornerbead on outside corners, unless otherwise indicated.
2. Edge trim complying with shape LC-bead per Fig. 1, unless otherwise indicated.

3. One-piece control joint formed from rolled zinc with V-shaped slot and removable strip covering slot opening.

2.6 JOINT TREATMENT MATERIALS

A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer.
3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer.
4. For topping compound, use sandable formulation.

2.7 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum panels.

C. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot-grouting hollow metal door frames.

D. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick

E. Steel drill screws of size and type recommended by unit manufacturer for fastening cementitious backer units.

F. Gypsum Board Nails: ASTM C 514.

G. Sound-Attenuation Blankets: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing).

1. Mineral-Fiber Type: Fibers manufactured from glass.
2. Thickness Doubled in and around Music Room.

H. Thermal Insulation: Material indicated below, of thickness and width to fill voids formed by Z-furring members:

1. Unfaced Mineral-Fiber Blanket Insulation: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing).

a. Mineral-Fiber Type: Fibers manufactured from glass.

2.8 TEXTURE FINISH PRODUCTS

A. Primer: Of type recommended by texture finish manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLING STEEL FRAMING, GENERAL

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Co.'s "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.

1. Where building structure abuts ceiling perimeter or penetrates ceiling.
4. Where partition framing and wall furring abut structure, except at floor.

a. Provide slip- or cushioned-type joints as detailed to attain lateral support and avoid axial loading.
b. Install deflection track top runner to attain lateral support and avoid axial loading.
c. Install deflection and firestop track top runner at fire-resistance-rated assemblies where indicated.

1) Attach jamb studs at openings to tracks using manufacturer's standard stud clip.

D. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

3.3 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.

1. Where studs are installed directly against exterior walls, install asphalt felt strips or foam gaskets between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

1. Cut studs 1/2 inch (13 mm) short of full height to provide perimeter relief.
2. For STC-rated and fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.

D. Terminate partition framing at suspended ceilings where indicated.

E. Install steel studs and furring in sizes and at spacings indicated.

1. Single-Layer Construction: Space studs 16 inches (406 mm) o.c., unless otherwise indicated.
2. Multilayer Construction: Space studs 16 inches o.c., unless otherwise indicated.
3. Multilayer Construction: Space studs 600 mm o.c., unless otherwise indicated.
4. Cementitious Backer Unit Construction: Space studs 16 inches (406 mm) o.c., unless otherwise indicated.
5. Stud space shall not exceed manufacturers recommended spacing for height of application.

F. Install steel studs so flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.

G. For curved partitions, install steel framing as follows:

1. Cut top and bottom runners through leg and web at 2-inch (50-mm) intervals for arc length. In cutting lengths of runners, allow for uncut straight lengths of not less than 12 inches (300 mm) at ends of arcs.
2. Bend runners to uniform curve of radius indicated and locate straight lengths so they are tangent to arcs.
3. Support outside (cut) leg of runners by clinching a 1-inch- (25-mm-) high-by-0.0209-inch-(0.55-mm-) thick steel sheet strip to inside of cut legs using metal lock fasteners.
4. Attach runners to structural elements at floor and roof structure with fasteners located 2 inches (50 mm) from ends and spaced 24 inches (610 mm) o.c.
5. Position studs vertically with open sides facing in same direction and engaging floor and ceiling runners. Begin and end each arc with a stud and space intermediate studs equally along arcs at stud spacing recommended by gypsum board manufacturer for radii indicated. Attach studs to runners with 3/8-inch- (9.5-mm-) long pan head framing screws. On straight lengths at ends of arcs, place studs 6 inches (150 mm) o.c. with last stud left free standing.

H. Frame door openings to comply with GA-219, and with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Install 2 studs at each jamb, unless otherwise indicated.
2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint.

3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

I. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.

J. Install thermal insulation as follows:

1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches (610 mm) 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 (600 mm) 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. Start from this furring channel with standard width insulation panel and continue in regular manner. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.
4. Until gypsum board is installed, hold insulation in place with 10-inch (250-mm) staples fabricated from 0.0625-inch (1.6-mm) diameter tie wire and inserted through slot in web of member.

## 3.4 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

B. Install sound-attenuation blankets, where indicated, prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

E. Locate both edge or 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. Avoid joints other than control joints at corners of framed openings where possible.

F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Instead, float gypsum panels over these members using resilient channels or provide control joints to counteract wood shrinkage.

I. Spot grout hollow metal door frames for solid-core wood doors, hollow metal doors, and doors over 32 inches (813 mm) wide. Apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.

J. Form control and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.

K. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases that are braced internally.

1. Except where 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. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

L. Isolate perimeter of nonload-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

M. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

1. Space screws a maximum of 8 inches o.c. for vertical applications.

N. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.

## 3.5 GYPSUM BOARD APPLICATION METHODS

A. Single-Layer Application: Install gypsum wallboard panels as follows:

1. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.
2. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

B. Wall Tile Substrates: For substrates indicated to receive thin-set ceramic tile and similar rigid applied wall finishes, comply with the following:

1. Install cementitious backer units to comply with ANSI A108.11 at locations indicated to receive wall tile.

## 3.6 INSTALLING TRIM ACCESSORIES

A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

B. Install cornerbead at all external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.

1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
3. Install U-bead where indicated.
4. Install aluminum trim and other accessories where indicated.

D. Install control joints according to ASTM C 840 and manufacturer's recommendations and in specific locations approved by Architect for visual effect.

1. At each side of door full height.
2. At maximum 30’ spacing in partitions and ceilings.

E. Install steel battens over joints to meet US Des. 4405 for prefinished gypsum board walls.

## 3.7 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints, except those with trim accessories having flanges not requiring tape.

D. Use one of the following joint compound combinations as applicable to the finish levels specified:

3. Embedding and First Coat: Setting-type joint compound. Fill (Second) Coat: Setting-type joint compound. Finish (Third) Coat: Sandable, setting-type joint compound.

E. Finish water-resistant gypsum backing board forming base for ceramic tile to comply with ASTM C 840 and gypsum board manufacturers directions for treatment of joints behind tile.

F. Apply joint compounds and tapes on all joints above the ceiling. Bed out all nail or screw heads above the ceiling. “Fire Tape” all joints and screw heads in concealed spaces.

## 3.8 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes according to texture finish manufacturer's instructions. Apply primer only to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish to gypsum panels and other surfaces indicated to receive texture finish according to texture finish manufacturer's directions. Using powered spray equipment, produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite

these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray as recommended by texture finish manufacturer to prevent damage.

D. Architect shall approve texture prior to final installation.

## 3.9 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Architect will conduct an above-ceiling observation prior to installation of gypsum board ceilings and report any deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect one week in advance of the date and the time when the Project, or part of the Project, will be ready for an above-ceiling observation.
2. Prior to notifying Architect, complete the following in areas to receive gypsum board ceilings:

    a. Installation of 80 percent of lighting fixtures, powered for operation.
    b. Installation, insulation, and leak and pressure testing of water piping systems.
    c. Installation of air duct systems.
    d. Installation of air devices.
    e. Installation of mechanical system control air tubing.
    f. Installation of ceiling support framing.

## 3.10 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09255

SECTION 092813 – CEMENT BACKER BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

A. B. Special Note: Much area of the building is to maintain exposed sealed concrete floors. All drywall mud and debris is to be promptly cleaned from floor as to not dry or discolor concrete.

1.2 SUMMARY

A. This Section includes the following:

1. Backer Board for Ceramic Tile.

B. Related Sections include the following:

1. Section 05400 – Cold Formed Metal Framing.
2. Section 06100 – Rough Carpentry.

1.3 REFERENCES

A. American National Standards Institute:

1. ANSI A118.9: Specification for Cementitious Backer Units.

B. American Society for Testing and Materials:

1. ASTM C 954: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inch to 0.110 inch in Thickness.
2. ASTM C 1002: Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
3. ASTM C 1280: Standard Specification for Application of Gypsum Sheathing.
4. ASTM C 1325: Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Interior Substrate Sheets.
5. ASTM D 226: Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
6. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
7. ASTM E119: Test Method for Fire Tests of Building Construction and Materials.
8. ASTM E 1677: Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls.

C. Gypsum Association:

1. GA 253: Recommended Specification for the Application of Gypsum Sheathing.

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01330

B. Product Data: Submit manufacturer's current technical literature for product specified.

1.5 QUALITY ASSURANCE

A. Fire Resistance Rated Assembly Characteristics: Provide materials and construction identical to those tested in accordance to ASTM E 119 by an independent testing and inspection agency acceptable to authorities having jurisdiction.

1. Fire Resistance Ratings: Indicated by design designations from UL Fire Resistance Directory.

1.6 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered in their original unopened packages and stored in an enclosed shelter providing protection from damage and exposure to the elements. WARNING: Store all Cement Board flat. Panels are heavy and can fall over, causing serious injury or death. Do not move unless authorized.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

A. Cementitious Fiber-Mat Reinforced Sheathing: ASTM C 1325, ANSI A118.9, cementitious backer.

1. Product: Subject to compliance with requirements, provide DUROCK Brand Cement Board by United States Gypsum Company or as approved by the Architect as indicated on the drawings.
2. Type and Thickness: 5/8 inch thick. Reference drawings
3. Size: 48 by 96 inches.

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and application.

B. Wood Screws: DUROCK Brand Wood or USG Sheathing WF screws 1-1/4 inch with corrosion-resistant coating.

C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: DUROCK Brand Steel or USG Sheathing SF steel drill screws 1-1/4 inch with corrosion-resistant coating.

1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

2.3 Joint Tape: Provide fiberglass tape over all joints in corners where ceramic tile is to be installed.

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.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Coordinate wall 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.

D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with ASTM C 1280, GA-253 and manufacturer's written instructions.
1. Fasten sheathing to cold-formed metal framing with screws.
2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install boards 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 boards but do not cut into facing.

C. Horizontal Installation: Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board 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 boards.
2. For sheathing under stucco cladding, boards 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 board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board 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 boards.
2. For sheathing under stucco cladding, boards 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.

END OF SECTION 092813


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# SECTION 093100 - CERAMIC TILE

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

B. Reference Alternate Section for options and variations of locations for tile.

### 1.2 SUMMARY

A. This Section includes the following:

1. Glazed wall tile.
2. Glazed floor tile

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
2. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Division 9 Section "Gypsum Board Assemblies" for cementitious backer units installed in gypsum wallboard assemblies.

### 1.3 DEFINITIONS

A. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

### 1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.
2. Step Treads: Minimum 0.6.
3. Ramp Surfaces: Minimum 0.8.

### 1.5 SUBMITTALS

A. Product Data: For each type of tile, mortar, grout, and other products specified.

B. Tile Samples for Selection: Manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection.

C. Grout Samples for Selection: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:

1. Joint sealants.
2. Waterproofing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the ceramic tile installation schedules at the end of this Section.

B. 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. Tile Products:

a. American Olean Tile Company.
b. Dal-Tile Corporation.
c. Florida Tile Industries, Inc.
d. American Marazzi Tile Inc.

2. Tile-Setting and -Grouting Materials:

a. American Olean Tile Company.
b. Dal-Tile Corporation.

## 2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.
2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.
2. Provide tile trim and accessories that match color and finish of adjoining flat tile.

D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

## 2.3 TILE PRODUCTS

A. Glazed Ceramic Tile: Provide flat tile complying with the following requirements. For Floors and Wall Applications

1. Manufacturer: Daltile –Affinity.
2. Thickness: 5/16”
3. Water Absorption ;less that 3%
4. Strength; 250lbs
5. Scratch hardness:8
6. Coefficient of friction: less than .60
7. Abrasion Resistance: 4
8. Size: 12” x12”; 4” x12”; 10” x 14” tile; 10” x 14” wall tile.
9. Color Pattern Determined by Architect using 2-3 different colors and lay-pattern.

B. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:

1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes:

a. Base: Sanitary Cove Base.
b. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose.
c. External Corners for Thin-Set Mortar Installations: Surface bullnose.
d. Internal Corners: Field-butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.

C. Accent Tile: Mosaic Glass and Metal Mosaic
1. Module Size: 5/8” x 5/8”.
2. Thickness: 5/16 inch.
3. Face: Plain with cushion edges.
4. Mounting: Factory back-mounted.
5. Provide Accent Boarders cut to 4” widths.
6. Manufacturer: American Olean Morello Metal & Glass Mosaics.
7. Grout: Non sanded - Poxy

D. Dry-Set Portland Cement Mortar: ANSI A118.1.

E. Bolin Wall Tile: Where matching existing 2x2.
1. Manufacturer: Daltile –Affinity.
2. Thickness: 5/16”
3. Water Absorption ;less that 3%
4. Strength; 250lbs
5. Scratch hardness:8
6. Coefficient of friction: less than .60
7. Abrasion Resistance: 4
8. Size 2x2
9. Large color pattern to be provided by Architect using full color template and solids to match existing.

2.5 GROUTING MATERIALS

A. Dry-Set Grout: ANSI A118.6, color as selected by Architect.

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.7 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.

1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.

G. Grout tile to comply with the requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.

## 3.4 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.

B. Joint Widths: Install tile on floors with the following joint widths:

1. Floor: 3/16”

## 3.5 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:

1. Wall Tile: 1/16 inch.

## 3.6 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

END OF SECTION 093100


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# SECTION 095113 - ACOUSTICAL PANEL CEILINGS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes ceilings consisting of acoustical panels and exposed suspension systems.

### 1.3 SUBMITTALS

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

B. Samples for Initial Selection: Manufacturer's color charts consisting of actual acoustical panels or sections of acoustical panels, suspension systems, and moldings showing the full range of colors, textures, and patterns available for each type of ceiling assembly indicated.

C. Sample: Units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Ceiling Units: Obtain each acoustical ceiling panel from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. Source Limitations for Suspension System: Obtain each suspension system from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

1. Obtain both acoustical ceiling panels and suspension system from the same manufacturer.

D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-response tests were performed by UL, ITS/Warnock Hersey, or another independent testing and inspecting agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
2. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

3. Fire-resistance-rated assemblies, which are indicated by design designations from UL's "Fire Resistance Directory," from ITS/Warnock Hersey's "Directory of Listed Products," or from the listings of another testing and inspecting agency, are identical in materials and construction to those tested per ASTM E 119.
4. Products are identified with appropriate markings of applicable testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size units equal to five (5) percent of amount installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated for each designation in the Acoustical Panel Ceiling Schedule at the end of Part 3.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing ASTM E 1264 pattern designations and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range of products that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

C. Panel Characteristics: Comply with requirements indicated in the Acoustical Panel Ceiling Schedule at the end of Part 3, including those referencing ASTM E 1264 classifications.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

B. Metal Suspension System Characteristics: Comply with requirements indicated in the Acoustical Panel Ceiling Schedule at the end of Part 3.

C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

D. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.

E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

F. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

G. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

H. 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.

I. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge

details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

J. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For interior ceilings consisting of acoustical panels weighing less than 1 lb/sq. ft., provide hold-down clips spaced 24 inches o.c. on all cross tees.

K. Hold-Down Clips for Vestibules: For Vestibules ceilings subject to wind pressure with opening of exterior doors, provide hold-down clips spaced at 24” o.c. on all cross tees.

## 2.4 ACOUSTICAL SEALANT

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:

1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates and 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 other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

## 3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.

2. No less than 6” panels are to be used adjacent to the walls.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. 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.

4. 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. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.

8. Do not attach hangers to steel deck tabs.

9. Do not attach hangers to steel roof deck. Attach hangers to structural members.

10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

   a. Install panels with pattern running in one direction parallel to long axis of space.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.
7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

## 3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

## 3.5 ACOUSTICAL PANEL CEILING SCHEDULE

A. Water-Felted, Mineral-Base Acoustical Panel Ceiling.

1. Products: Available product is limited to:
   a. Armstrong Cortega #770.
2. Classification: Panels fitting ASTM FE 1264.
3. Color: White
4. Light Reflectange: .90.
5. Noise Reduction: .70.
6. Ceiling Attention Class (CAC): 35.
7. Edge Detail: Beveled Tegular.

8. Thickness: 3/4”
9. Size: 24”x24”
10. Location: All locations noted as 24” x 24” acoustical ceiling. Reference Finish Schedule.

3.6 DIRECT HUNG GRID SYSTEM SCHEDULE – REFERENCE ALTERNATES

A. Steel direct hung exposed system.

1. Products: Available products include but are not limited to:
   a. Armstrong Prelude XL 7300.
2. ASTM Class: Intermediate Duty.
3. Face Width: 9/16”
4. 6. Wall Angle: Match Grid Square Edge.
7. Location: Generally use with all panels. Refer to the “Finish Schedule” (sec. 09990) for specific locations.

END OF SECTION 095113


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# ECTION 095446 - FABRIC

## 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 fabric-wrapped cushions, seating backs and benches.

### 1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Fain Fine Arts Lobby.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include fabric edge, core material, and mounting indicated.

B. Shop Drawings: For cushion assembly and installation.

1. Include details at joints and corners;
2. Include direction of fabric weave and pattern matching.

C. Samples for Initial Selection: For each type of fabric.

1. Include Samples of accessories involving color or finish selection.

D. Samples for Verification: For the following products:

1. Fabric: Full-width by approximately 24-inch long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
2. Cushion Edge: 12-inch Sample(s) showing each edge profile, corner, and finish.
3. Core Material: 12-inch- (300-mm-) square Sample at corner.
4. Assembled Cushions: Approximately 24 by 36 inches, including joints and mounting methods.

### 1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Show components layouts and corners covered by or adjacent to fabric.

B. Product Certificates: For each type of fabric.

C. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of fabric to include in maintenance manuals. Include fabric manufacturer's written cleaning and stain-removal instructions.

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. Fabric: For each fabric, color, and pattern installed, furnish length equal to 10 percent of amount installed, but no fewer than 10 sq. yd., full width of bolt.

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, fabrication, and installation.

1. Build mockup of cushion 24 inch x 36 inch.)
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and cushion manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and cushions in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install cushions until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Air-Quality Limitations: Protect cushions from exposure to airborne odors, such as tobacco smoke, and install cushions under conditions free from odor contamination of ambient air.

C. Field Measurements: Verify cushion locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace cushions and components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Fabric sagging, distorting, or releasing from cushion edge.
b. Warping of core.

2. Fabric Warranty Period: Five years from date of Substantial Completion for standard wear or color loss.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fabric- from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Surface-Burning Characteristics: Comply with NFPA 260 Class 1.

2.3 MATERIAL:

A. Fabric: Manufacturer's standard construction consisting of facing material bonded to front face, edges, and back edge border of core.

1. Cushion Shape: (Match Existing).
2. Nominal Thickness: 2 inches (Match Existing).
3. Cushion Width: (Match Existing).
4. Manufacturer: Mayer Fabrics.
5. Product Line/Pattern: Seating Fabrics.
6. Pattern Repeat: Non-Matching Crypton engineered fabric to be selected by Architect/Owner.
7. Color: To be selected by Architect/Owner.
8. Fiber Content: 100 percent woven polyester.
9. Width: 54 inches.
10. Source: Hudsons Interiors – Donna Murray.
11. Stain resistance; flame-retardant.
12. Abrasion: 50,000 Double rubs/minute.
13. Weight: 14 oz. min.
14. Cleaning Code: C
15. Breaking Strength: ASTM – D 5034 Grab Test.

B. Core Materials: Match existing dense foam backed with plywood cut to shape.

2.4 FABRICATION

A. Standard Construction: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce cushion perimeter against warpage and damage.

B. Measure each area and establish layout of cushions and joints within a given area.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting cushion and fabric performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cushion in locations indicated. Unless otherwise indicated, install units with edges in alignment with walls and other cushions, to fit adjoining work accurately at borders and at penetrations.

B. Align fabric pattern and grain with adjacent cushions.

3.3 INSTALLATION TOLERANCES

A. Variation from Alignment with Surfaces: Plus or minus 1/16 inch noncumulative.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean cushions on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 095446

Sample of Existing covered seating to be Re-Covered in new Fabric. All new seating areas indicated on plans are to match the existing size, thickness and style of these fabric covered bench and backs.


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# SECTION 096500 – RESILIENT TILE FLOORING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Vinyl composition floor tile.

B. Related Sections include the following:

1. Division 9 Section "Resilient Wall Base and Accessories" for resilient wall base, reducer strips, and other accessories installed with resilient floor tiles.

### 1.3 SUBMITTALS

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

B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors and patterns available for each type of product indicated.

C. Samples for Verification: Full size tiles of each different color and pattern of resilient floor tile specified, showing the full range of variations expected in these characteristics.

1. For resilient accessories, manufacturer’s standard-size samples of each resilient accessory color and pattern specified.

D. Product Certificates: Signed by manufacturers of resilient products certifying that each product furnished complies with requirements.

E. Maintenance Data: For resilient floor tile to include in the maintenance manuals specified in Division 1.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F.

C. Store tiles on flat surface.

D. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F or more than 95 deg F in spaces to receive products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After post-installation period, maintain a temperature of not less than 55 deg F or more than 95 deg F.

B. Do not install products until they are at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during flooring installation and for time period after installation recommended in writing by manufacturer.

D. Install tiles and accessories after other finishing operations, including painting, have been completed.

E. Where demountable partitions and other items are indicated for installation on top of resilient tile flooring, install tile before these items are installed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Furnish not less than one box for each 50 boxes of fraction thereof, each type, color, pattern, class, wearing surface, and size of resilient tile flooring installed.

2. Deliver extra materials to Owner.

## PART 2 - PRODUCTS

### 2.1 RESILIENT TILE

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   1. Armstrong World Industries, Inc.
   2. Azrock Commercial Flooring, DOMCO
   3. Tarkett Inc.

B. Vinyl Composition Floor Tile: Products complying with ASTM F 1066 and with requirements specified in the Resilient Tile Flooring Schedule.

   1. Color and Pattern: As selected by Architect from manufacturer's full range of colors and patterns produced for tile complying with requirements indicated to create 3-color tile accent patterns and/or bands in some areas (Ref. "Finish Schedule", Section 09990). Class: Class 1 (solid-color tile) 30%; Class 2 (through-pattern tile) 70%.
   2. Thickness: 1/8 inch
   3. Size: 12x12 inches

C. Provide Transition Strips at each door or level change or change in flooring material.

### 2.2 RESILIENT ACCESSORIES

A. Rubber Wall Base: Products complying with FS SS-W-40, Type I and with requirements specified in the Resilient Tile Flooring Schedule.

B. Rubber Accessory Moldings: Products complying with requirements specified in the Resilient Tile Flooring Schedule.

C. Vinyl Accessory Moldings: Products complying with requirements specified in the Resilient Tile Flooring Schedule.

### 2.3 INSTALLATION ACCESSORIES

A. Trowable Leveling and Patching Compounds: Latex-modified, Portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated..

B. Adhesives: Water-resistant type recommended to suit resilient products and subtrate conditions indicated.

C. Metal Edge Strips: Extruded aluminum with mill finish width shown, of height required to protect exposed edge of tiles, and in maximum available lengths to minimize running joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that subtrates and conditions are satisfactory for resilient product installation and comply with requirements specified.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving flooring.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

B. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Comply with tile manufacturer’s written installation instructions.
1. Architect reserves the right to produce a 3-color scheme pattern..

3.4 RESILIENTACCESSORY INSTALLATION

A. General: Install resilient accessories according to manufacturer's written installation instructions.

B. Place resilient accessories so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

3.5 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
2. Sweep or vacuum floor thoroughly.
3. Do not wash floor until after time period recommended by flooring manufacturer.
4. Damp-mop floor to remove marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by flooring manufacturer.

1. Apply protective floor polish to floor surfaces that are free from soil, visible adhesive, and surface blemishes, if recommended in writing by manufacturer.

a. Use commercially available product acceptable to flooring manufacturer.
b. Coordinate selection of floor polish with Owner's maintenance service.

2. Cover products installed on floor surfaces with undyed, untreated building paper until inspection for Substantial Completion.
3. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

C. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

1. Before cleaning, strip protective floor polish that was applied after completing installation only if required to restore polish finish and if recommended by flooring manufacturer.
2. After cleaning, reapply polish to floor surfaces to restore protective floor finish according to flooring manufacturer's written recommendations. Coordinate with Owner's maintenance program.

END OF SECTION 09651


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# SECTION 096513 - RESILIENT WALL BASE AND ACCESSORIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Resilient wall base (with premolded "inside" and "outside" corners).
2. Resilient flooring accessories.
3. Resilient carpet accessories.

B. Related Sections include the following:

1. Division 9 Section "Resilient Tile Flooring."

### 1.3 SUBMITTALS

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

B. Samples for Initial Selection: Manufacturer's standard sample sets consisting of sections of units showing the full range of colors and patterns available for each type of product indicated.

C. Samples for Verification: In manufacturer's standard sizes of each product color and pattern specified.

D. Product Certificates: Signed by manufacturers of resilient wall base and accessories certifying that each product furnished complies with requirements.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F.

C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F or more than 95 deg F in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 55 deg F or more than 95 deg F (35 deg.

B. Do not install products until they are at the same temperature as the space where they are to be installed.

C. For resilient products installed on traffic surfaces, close spaces to traffic during installation and for time period after installation recommended in writing by manufacturer.

D. Coordinate resilient product installation with other construction to minimize possibility of damage and soiling during remainder of construction period. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof, of each different type, color, pattern, and size of resilient product installed.
2. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Resilient Wall Base and Accessory Schedule at the end of Part 3.

2.2 RESILIENT WALL BASE

A. Rubber Wall Base: Products complying with FS SS-W-40, Type I and with requirements specified in the Resilient Wall Base and Accessory Schedule.

2.3 RESILIENT ACCESSORIES

A. Rubber Accessories: Products complying with requirements specified in the Resilient Wall Base and Accessory Schedule.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements, including those for maximum moisture content. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, 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.

D. Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Install resilient products according to manufacturer's written installation instructions.

B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
3. Do not stretch base during installation.

4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
5. Install premolded outside corners before installing straight pieces.
6. Install premolded outside and inside corners before installing straight pieces.
7. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
8. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

## 3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
2. Sweep or vacuum horizontal surfaces thoroughly.
3. Do not wash resilient products until after time period recommended by resilient product manufacturer.
4. Damp-mop or sponge resilient products to remove marks and soil.

B. Protect resilient products against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by resilient product manufacturer.

1. Apply protective floor polish to vinyl resilient products installed on floors and stairs that are free from soil, visible adhesive, and surface blemishes, if recommended by manufacturer.

    a. Use commercially available product acceptable to resilient product manufacturer.
    b. Coordinate selection of floor polish with Owner's maintenance service.

2. Cover resilient products installed on floors and stairs with undyed, untreated building paper until inspection for Substantial Completion.

C. Clean resilient products not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

1. Before cleaning, strip protective floor polish that was applied to vinyl products on floors and stairs after completing installation only if required to restore polish finish and if recommended by resilient product manufacturer.
2. After cleaning, reapply polish on vinyl products on floors and stairs to restore protective floor finish according to resilient product manufacturer's written recommendations. Coordinate with Owner's maintenance program.

3.5 RESILIENT WALL BASE AND ACCESSORY SCHEDULE

A. Rubber Wall Base: Where this designation is indicated, provide rubber wall base complying with the following:

1. Manufacturers

a. Flexco Div. Textile Rubber Co.
b. Johnsonite Flooring Co.
c. Roppe Rubber Corp.

2. Color and Pattern: As selected by Architect from manufacturer's full range of colors and patterns produced for rubber wall base complying with requirements indicated
3. Style: Cove with top-set toe
4. Minimum Thickness: 1/8 inch
5. Height: 4 inches
6. Lengths: Coils in lengths standard with manufacturer, but not less than 96 feet.
7. Outside Corners: Premolded.
8. Inside Corners: Premolded.
9. Surface: Matte finish.

B. Rubber Accessory Molding: Where this designation is indicated, provide rubber accessory molding complying with the following:

1. Manufacturers:

a. Flexco Div. Textile Rubber Co.
b. Johnsonite Flooring Co.
c. Roppe Rubber Corp.

2. Color: As selected by Architect from manufacturer's full range of colors produced for rubber accessory molding complying with requirements indicated.
3. Product Description: Carpet edge for glue-down applications.
4. Carpet nosing
5. Nosing for rubber tile
6. Reducer strip for resilient flooring
7. Tile and carpet joiner.
8. Profile and Dimensions: As specified by product designation indicated above

END OF SECTION 09653


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SECTION 096600 - TERRAZZO TILE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. General – Terrazzo Tile is installed using the thin set mortar method and it is to be installed by Hard Tile Contractors. It is important that the installation substrate be properly level, clean and free of any dust, sealers or waxes to allow proper adhesion to the substrate.

B. Include pre-cast, thermoset, polymer based 47-¾" x 47-¾" x 5/16" terrazzo tile, with integral high tension core, here in after called Terrazzo, indicated on the drawings and specified herein:

1.3 RELATED WORK DESCRIBED UNDER OTHER SECTIONS

A. Finish and preparation of existing concrete or terrazzo floors to receive Terrazzo.

1.4 QUALITY ASSURANCE

A. Qualification of installers:

1. For actual installation of Terrazzo Tile use only experienced, Journeyman installers completely familiar with the installation methods of Terrazzo and the Tile Council of North America hereafter called TCNA.

2. In acceptance or rejection of installed Terrazzo, no allowance will be made for lack of skill on the part of the installer.

B. Manufacturer's Recommendations: The installation recommendation of the manufacturer of Terrazzo, when approved by the architect, shall be the basis for acceptance or rejection of actual installation methods used in this work.

1.5 SUBMITTALS

A. Samples: Submit two sets of small samples of Terrazzo Tile for approval by contracting officer.

B. Maintenance materials: Furnish owner, without additional cost, a thirty day supply of Plaza, Acrylic Floor Finish, manufactured by Johnson's Wax. Materials are to be supplied in un-opened packages or containers and are to have complete use instructions.

The Terrazzo installer shall instruct the owner of the building in the proper care and maintenance of the floor within one week of final approval and acceptance.

1.6 PRODUCT HANDLING:

A. Store all Terrazzo and related installation material in a flat, clean, dry area where temperatures shall be maintained above 40ºF with normal humidity until three days before installation begins.

B. Three days prior to installation the entire quantity of Terrazzo to be installed shall be moved into the installation area where a minimum temperature of 70ºF has been Maintained for two days prior to moving the Terrazzo into the installation area. The Terrazzo shall remain in the installation area for three days at a minimum temperature of 70º prior to installation.

C. Use all means necessary to protect the Terrazzo before, during and after installation from damage or abuse from other trades. It is desirable when possible to make the Terrazzo installation the final item in the construction program.

D. In the event of damage, immediately make all repairs and replacements necessary to the satisfaction and approval of the architect and at no additional cost to the owner.

PART 2 – PRODUCT

2.1 PRODUCT - PRE-CAST, THIN SET, TERRAZZO TILE

A. Terrazzo 47-¾” x 47-¾” x 5/16” Tile shall be (*Product Number and Color*) as manufactured by Surface Elements, Inc., P.O. Box 82 Loretto, TN 38469. If the color for the project is different from the Standard Terrazzo Color Line, a 2’ x 2’ tile and two 6" x 6" approval samples of each custom color must be provided to the architect for approval before the order is released for production

1. HARDNESS -
   a. BARCOL-ASTM D-2583 Impressor-934-1 SHORE-ASTM D-2240; Aggregate 83.3 Matrix 64.4

2. IDENTATION
   a. 1 lb. steel ball applied with 200 lbs. of pressure for 30 minutes at 77 degree F; Indentation...0.009 inches

3. SPECIFIC GRAVITY
   a. ASTM D-792; 2.20

4. THERMAL SHOCK
   a. MIL-F-52505; No evidence of peeling, cracking, crazing or deterioration

5. WATER ABSORPTION
   a. ASTM D-570, Immersion in 75 degree F water for 24 hours after conditioning for 24 hours at 212 degree F; 1.40%

6. WEIGHT
   a. 3.5 lbs. per square foot

6. SIZE
   a. 47-¾" x 47-¾" x 5/16" and 47-¾" x 97-¾" x 5/16".

PART 3 - EXECUTION

3.1 EXECUTION: PREPARATION:

A. Do not begin installation of Terrazzo until the building has been held to a minimum temperature of 70º for five full days and the entire quantity of the Terrazzo and thin set mortar and grout have been stored inside the building for three full days. Maintain a minimum of 70º throughout the installation period.

B. INSTALLATION MATERIALS

1. Installation materials for Terrazzo tiles shall be as supplied by LATICRETE International, Inc., Bethany, CT USA. Telephone: 1-800-243-4788 or (203) 393-0010, Fax: (203) 393-1684, Email: technicalservices@laticrete.com Internet: www.laticrete.com.

C. SURFACE PREPARATION MATERIALS:

1. LATICRETE® 86 LatiLevel™ self-leveling underlayment and LATICRETE Admix & Primer – apply LATICRETE Admix and Primer in accord with manufacturer's installation instructions. Allow primer to tack up and then apply LATICRETE 86 LatiLevel self leveling underlayment (up to 1 ½" [37mm]) thickness - (see product data sheets 662.0, 238.9 and 002.4).
2. LATICRETE 816 LatiPatch to repair and flash patch concrete floors up to ½" (12mm) thickness per lift.

3.2 SUBSTRATE REQUIREMENTS / PREPARATION

Note: Substrates must meet the maximum allowable deflection standard of L/480 for Terrazzo tile finishes under total anticipated load.

Prior to commencing the installation, the contractor shall examine the areas to be covered and advise the General Contractor and Architect of any existing conditions or surface contamination which will require correction before the work commences. Before starting, surface to be covered shall be cleaned to remove curing compounds, sealers, soil, mortar, dirt, dust, etc. Curing compounds or sealers shall be removed by "bead-blasting," grit / sand blasting or diamond wheel grinder with dustless vacuum attachment or equivalent methods of mechanical "scarifying." After removal of the curing compounds or sealers all rough, uneven or "out-of-plumb" surfaces shall be made "plumb and true" to within 1/8" in 10' (3 mm in 3 m) and 1/16" in 1' (1.5 mm 300 mm) using a LATICRETE Surface Preparation product as outlined under the installation materials section. Dry or dusty concrete or masonry surfaces shall be wet down or washed and excess water removed just prior to the application of the adhesive mortar.

A. TCNA F-113 – FLOOR - Thin Bed Floor Method using LATICRETE® 254 Platinum multipurpose thin set mortar. See LATICRETE product data sheet 677.0. For full installation details and specifications see LATICRETE installation specification ES-F113 – www.laticrete.com.ag.

B. TCNA F-111 – FLOOR - Unbonded Thick Mortar bed / Cleavage Membrane with wire reinforcing. Mortar bed consists of LATICRETE 3701 Fortified Mortar Bed. Use LATICRETE 254 Platinum as a bond coat to wet set into the fresh mortar bed or as a thin bed mortar over the hardened mortar bed. See LATICRETE

product data sheets 100.0 & 677.0. For full installation details and specifications see LATICRETE installation specification ES-F111 – www.laticrete.com.ag.

C. TCNA F112 – FLOOR - Bonded Mortar bed. Slurry bond to attached mortar bed to concrete slab shall be LATICRETE 254 Platinum. Embed mortar bed into the slurry bond coat while wet and tacky. Mortar bed consists of LATICRETE 3701 Fortified Mortar Bed. Use LATICRETE 254 Platinum as a bond coat to wet set into the fresh mortar bed or as a thin bed mortar over the hardened mortar bed. See LATICRETE product data sheets 100.0 & 677.0. For full installation details and specifications see LATICRETE installation specification ES-F112 – www.laticrete.com.ag.

D. TCNA W260 or W215 – WALL - Epoxy Spot Bond for Interior Wall Applications over cement backer board or concrete / masonry substrates. Epoxy Spot Bond Adhesive shall be LATAPOXY® 310 Stone Adhesive (Standard or Rapid Grade). See LATICRETE product data sheets 679.0 & 679.3. For full installation details and specifications; see LATICRETE installation specification ES W265 – www.laticrete.com.ag

1. Crack Isolation Membrane shall be LATICRETE® Hydro Ban™. See LATICRETE product data sheets 663.0 & 663.5. Waterproofing Membrane shall be LATICRETE Hydro Ban. See LATICRETE product data sheets 663.0 & 663.5.

2. Grout shall be one of the following:

   a. LATICRETE SpectraLOCK® PRO Grout (see LATICRETE product data sheet 685.0 and 685.5)LATICRETE PermaColor™ Grout (see LATICRETE product data sheet 250.0) LATICRETE 1600 Unsanded Grout gauged with LATICRETE 1776 Grout Enhancer (see LATICRETE product data sheets 258.0 and 265.0)

3. Silicone Sealants shall be LATICRETE Latasil™ silicone sealant (see LATICRETE product data sheet 6200.1)
   NOTE: Use Latasil 9118 Primer for use in all submerged applications and to improve adhesion in all applications (see LATICRETE product data sheet 6528.1)

4. Silicone Sealants shall be LATICRETE Latasil™ silicone sealant (see LATICRETE product data sheet 6200.1)

   NOTE: Use Latasil 9118 Primer for use in all submerged applications and to improve adhesion in all applications (see LATICRETE product data sheet 6528.1

   Follow all ceramic tile and stone industry installation guidelines (including expansion joint design, construct and placement) as outlined in the Tile Council of North America's (TCNA) TCA Handbook for Ceramic Tile Installations and the American National Standard Specifications for the Installation of Ceramic Tile handbook (ANSI), the project specifications, details and the written installation instructions of LATICRETE International, Inc.

3.3 INSTALLATION OF WATERPROOFING AND CRACK SUPPRESSION MEMBRANE

A. Waterproof membrane is installed before tile is installed in all wet areas and wet areas that are above occupied or enclosed areas. Crack isolation membrane is installed before tile is installed over all hairline cracks (≤ 1/8” or 3mm) in surfaces to receive new tile work. LATICRETE Hydro Ban can be used for both waterproofing and crack isolation membrane applications.

3.4 ADHESIVE MORTAR INSTALLATION INSTRUCTIONS

A. MIXING

1. Follow the mixing and installation instructions for each of the individual LATICRETE products used by consulting the product data sheet, installation instructions on the product packaging, how-to-install instructions and the complete installation specification and details found at www.laticrete.com/ag. The product data sheets can be viewed and/or download by visiting www.laticrete.com

B. INSTALLATION OF TILE BY THINBED METHOD

1. The thin bed adhesive shall be applied with a notched trowel using a scraping motion to work the material into good contact with the surface to be covered. A trowel having notches large enough to insure "full bedding" of the tiles is recommended. Only as much adhesive shall be applied as can be covered within 10-15 minutes, or while adhesive surface is still wet and tacky. When installing Terrazzo® Large Format Tile a small quantity of the adhesive shall be applied to the back of each tile. Tile shall then be set in place and pressed firmly to insure 100% full bedding and a true surface. Tile shall be aligned to show uniform joints and then allowed to set until firm. Excess adhesive must be cleaned from the surface of the tile with a wet cloth or sponge while the adhesive is fresh.

C. INSTALLATION OF TILE BY SPOT BOND METHOD (Interior Vertical Applications Only)

1. Store epoxy resins at room temperature 70°F (21°C) for 24 hours before using. All substrates must be clean when application of LATAPOXY® 310 Stone Adhesive is made. Clean the back of the tile at areas to receive the LATAPOXY 310 Stone Adhesive. Using a damp sponge (not wet), wipe the tile to remove any particles or remaining dust to ensure a clean direct bond and that all ground material is removed. Wipe dry with a clean cloth, then apply LATAPOXY 310 Stone Adhesive. Apply dabs evenly distributed on back of the tile; 5 dabs minimum, 1 in each corner and 1 in center. Cover at least 10% of the facial area of each piece. Finished dab thickness must be a minimum of 1/8” (3mm). After application of LATAPOXY 310 Stone Adhesive onto the tile, place tile onto substrate and adjust for plumb and level.

3.5 GROUTING AND POINTING JOINTS

A. Follow the mixing and installation instructions contained in the product packaging, data sheets and how to install instructions for the grouting product that will be utilized. Joints shall be packed full and free of all voids and pits. (Tool or rake as specified). Excess grout shall be cleaned from the surface as the work progresses, while grout is fresh and before it hardens. The day after installation grout film or haze shall be removed using a neutral Ph detergent solution. Epoxy grout haze should be removed the same day as indicated in the printed product instructions. No acids should be used for cleaning tile work.

3.6 EXPANSION AND CONTROL JOINTS

A. Use LATICRETE® Latasil silicone sealant where a flexible silicone sealant is required and for use in movement joints. Follow industry guidelines for the design, placement and construct of movement joints. Reference Tile Council of North America's Guidelines EJ-171 and the American National Standard Specifications for the Installation of Ceramic Tile A108.01 – 3.7 Requirements for movement joints.

3.7 PROTECTION

A. The contractor shall take precautions to protect the finished work from damage by other trades. Do not allow construction traffic on fresh grout joints. Allow the cement grout to cure for a minimum of 7 days at 70° F (21° C) before aggressive cleaning. *NOTE: Steam cleaning LATICRETE SpectraLOCK Grout is not recommended.*

B. COLD WEATHER NOTE:

1. The curing of portland cement based terrazzo tile and stone installation mortars, adhesives & grouts is retarded by low temperatures and finished work should be protected for an extended period of time.

C. WET AREA NOTE:

1. When using LATICRETE latex fortified cement grout allow tile work in wet areas such as swimming pools and fountains to cure for 14 days at 70° F (21° C) before exposing to immersion. When using LATICRETE SpectraLOCK PRO Grout allow tile work in wet areas, such as swimming pools and fountains to cure for a minimum of 10 days at 70° F (21° C) before exposing to immersion.

2. Silicone Sealants shall be LATICRETE Latasil™ silicone sealant (see LATICRETE product data sheet 6200.1)

NOTE: Use Latasil 9118 Primer for use in all submerged applications and to improve adhesion in all applications (see LATICRETE product data sheet 6528.1

Follow all ceramic tile and stone industry installation guidelines (including expansion joint design, construct and placement) as outlined in the Tile Council of North America's (TCNA) TCA Handbook for Ceramic Tile

Installations and the American National Standard Specifications for the Installation of Ceramic Tile handbook (ANSI), the project specifications, details and the written installation instructions of LATICRETE International, Inc.

3.8 INSTALLATION OF WATERPROOFING AND CRACK SUPPRESSION MEMBRANE

A. Waterproof membrane is installed before tile is installed in all wet areas and wet areas that are above occupied or enclosed areas. Crack isolation membrane is installed before tile is installed over all hairline cracks (≤ 1/8” or 3mm) in surfaces to receive new tile work. LATICRETE Hydro Ban can be used for both waterproofing and crack isolation membrane applications.

3.9 ADHESIVE MORTAR INSTALLATION INSTRUCTIONS

A. MIXING

1. Follow the mixing and installation instructions for each of the individual LATICRETE products used by consulting the product data sheet, installation instructions on the product packaging, how-to-install instructions and the complete installation specification and details found at www.laticrete.com/ag. The product data sheets can be viewed and/or download by visiting www.laticrete.com.

B. INSTALLATION OF TILE BY THINBED METHOD

1. The thin bed adhesive shall be applied with a notched trowel using a scraping motion to work the material into good contact with the surface to be covered. A trowel having notches large enough to insure "full bedding" of the tiles is recommended. Only as much adhesive shall be applied as can be covered within 10-15 minutes, or while adhesive surface is still wet and tacky. When installing Terrazzo® Large Format Tile a small quantity of the adhesive shall be applied to the back of each tile. Tile shall then be set in place and pressed firmly to insure 100% full bedding and a true surface. Tile shall be aligned to show uniform joints and then allowed to set until firm. Excess adhesive must be cleaned from the surface of the tile with a wet cloth or sponge while the adhesive is fresh.

C. INSTALLATION OF TILE BY SPOT BOND METHOD (Interior Vertical Applications Only)

1. Store epoxy resins at room temperature 70°F (21°C) for 24 hours before using. All substrates must be clean when application of LATAPOXY® 310 Stone Adhesive is made. Clean the back of the tile at areas to receive the LATAPOXY 310 Stone Adhesive. Using a damp sponge (not wet), wipe the tile to remove any particles or remaining dust to ensure a clean direct bond and that all ground material is removed. Wipe dry with a clean cloth, then apply LATAPOXY 310 Stone Adhesive. Apply dabs evenly distributed on back of the tile; 5 dabs minimum, 1 in each corner and 1 in center. Cover at least 10% of the facial area of each piece. Finished dab thickness must be a minimum of 1/8” (3mm). After application of LATAPOXY 310 Stone Adhesive onto the tile, place tile onto substrate and adjust for plumb and level.

3.10 GROUTING AND POINTING JOINTS

A. Follow the mixing and installation instructions contained in the product packaging, data sheets and how to install instructions for the grouting product that will be utilized. Joints shall be packed full and free of all voids and pits. (Tool or rake as specified). Excess grout shall be cleaned from the surface as the work progresses, while grout is fresh and before it hardens. The day after installation grout film or haze shall be removed using a neutral Ph detergent solution. Epoxy grout haze should be removed the same day as indicated in the printed product instructions. No acids should be used for cleaning tile work.

3.11 EXPANSION AND CONTROL JOINTS

A. Use LATICRETE® Latasil silicone sealant where a flexible silicone sealant is required and for use in movement joints. Follow industry guidelines for the design, placement and construct of movement joints. Reference Tile Council of North America's Guidelines EJ-171 and the American National Standard Specifications for the Installation of Ceramic Tile A108.01 – 3.7 Requirements for movement joints.

3.12 PROTECTION

A. The contractor shall take precautions to protect the finished work from damage by other trades. Do not allow construction traffic on fresh grout joints. Allow the cement grout to cure for a minimum of 7 days at 70° F (21° C) before aggressive cleaning. *NOTE: Steam cleaning LATICRETE SpectraLOCK Grout is not recommended.*

B. COLD WEATHER NOTE:

1. The curing of portland cement based terrazzo tile and stone installation mortars, adhesives & grouts is retarded by low temperatures and finished work should be protected for an extended period of time.

C. WET AREA NOTE:

1. When using LATICRETE latex fortified cement grout allow tile work in wet areas such as swimming pools and fountains to cure for 14 days at 70° F (21° C) before exposing to immersion. When using LATICRETE SpectraLOCK PRO Grout allow tile work in wet areas, such as swimming pools and fountains to cure for a minimum of 10 days at 70° F (21° C) before exposing to immersion.

END OF SECTION 096600

# SECTION 096623 - RESINOUS MATRIX TERRAZZO 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. Thin-set, epoxy-resin terrazzo flooring – Patch.
2. Terrazzo Wall Base – Rolled in place.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealants installed with terrazzo.
2. Section 096723 "Resinous Flooring" for decorative resinous flooring systems applied as self-leveling slurries or as troweled or screeded mortars.

### 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to terrazzo including, but not limited to, the following:

a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
c. Review special terrazzo designs and patterns to match existing.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include terrazzo installation requirements. Include plans, sections, component details, and relationship to other work. Show layout of the following:

1. Divider strips.
2. Control-joint strips.
3. Accessory strips.
4. Terrazzo patterns to match existing.

C. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

D. Samples for Initial Selection: NTMA's "Terrazzo Color Palette" showing the full range of colors and patterns available for each terrazzo type.

E. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo Sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in sizes indicated below:

1. Terrazzo: 6-inch square Samples.
2. Accessories: 6-inch long Samples of each exposed strip item required.

## 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each type of terrazzo material or product.

C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

D. Preinstallation moisture-testing reports.

## 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For terrazzo to include in maintenance manuals.

## 1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Engage an installer who is a contractor member of NTMA.
2. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.

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. 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. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

B. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.

C. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

D. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

B. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. NTMA Standards: Comply with NTMA's written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.3 EPOXY-RESIN TERRAZZO

A. Epoxy-Resin Terrazzo: Comply with manufacturer's written instructions for matrix and aggregate proportions and mixing.

B. Mix Color and Pattern: To match existing.

C. Materials:

1. Moisture-Vapor-Emission-Control Membrane: Two-component, high-solids, high-density, low-odor, epoxy-based membrane-forming product produced by epoxy terrazzo manufacturer that reduces moisture emission from concrete substrate to not more than 3 lb of water/1000 sq. ft. in 24 hours.
2. Substrate-Crack-Suppression Membrane: Product of terrazzo-resin manufacturer, having minimum 120 percent elongation potential according to ASTM D 412.

a. Reinforcement: Fiberglass scrim.

3. Primer: Manufacturer's product recommended for substrate and use indicated.
4. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated to match existing.

a. Physical Properties without Aggregates:

1) Hardness: 60 to 85 per ASTM D 2240, Shore D.
2) Minimum Tensile Strength: 3000 psi per ASTM D 638 for a 2-inch specimen made using a "C" die per ASTM D 412.
3) Minimum Compressive Strength: 10,000 psi per ASTM D 695, Specimen B cylinder.
4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D 1308.

a) Distilled water.
b) Mineral water.
c) Isopropanol.
d) Ethanol.
e) 0.025 percent detergent solution.
f) 1.0 percent soap solution.
g) 5 percent acetic acid.
h) 10 percent sodium hydroxide.
i) 10 percent hydrochloric acid.
j) 30 percent sulfuric acid.

b. Physical Properties with Aggregates: To match existing; terrazzo blended according to manufacturer's recommendations with one part epoxy resin with three parts marble aggregate consisting of 60 percent No. 1 chips and 40 percent No. 0 chips that is ground and grouted to a 1/4-inch nominal thickness, and cured for 7 days at 75 deg F plus or minus 2 deg F and at 50 percent plus or minus 2 percent relative humidity.

1) Flammability: Self-extinguishing, maximum extent of burning 1/4 inch according to ASTM D 635.
2) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F according to ASTM C 531.

5. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.

a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131/C 131M.
b. 24-Hour Absorption Rate: Less than 0.75 percent.
c. Dust Content: Less than 1.0 percent by weight.

6. Finishing Grout: Resin based.

## 2.4 STRIP MATERIALS

A. Thin-Set Divider Strips: L-type angle in depth required for topping thickness indicated.

1. Material: Aluminum – to match existing.

2. Top Width: 1/8 inch – to match existing.

B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.

## 2.5 MISCELLANEOUS ACCESSORIES

A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use.

B. Anchoring Devices:

1. Strips: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and as required for secure attachment to substrate.
2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by fabricator for proper anchorage and support of units for conditions of installation and support.

C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

D. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

E. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; and is recommended by sealer manufacturer.

1. Surface Friction: Not less than 0.6 according to ASTM D 2047.
2. Acid-Base Properties: With pH factor between 7 and 10.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

## 3.2 PREPARATION

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs:

1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.

    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. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written instructions.
    c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.

C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

D. Preinstallation Moisture Testing:

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Moisture-Vapor-Emission Test: Maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours when tested according to ASTM F 1869 using anhydrous calcium chloride.
    b. Relative Humidity Test: Maximum 75 percent relative humidity measurement when tested according to ASTM F 2170 using in-situ probes.

2. Proceed with terrazzo installation only after concrete substrates pass moisture testing.

E. Moisture-Vapor-Emission-Control Membrane: Install according to manufacturer's written instructions.

1. Install on concrete substrates that incorporate lightweight aggregates.
2. Install concrete substrates that fail preinstallation moisture testing.

F. Substrate-Crack-Suppression Membrane: Install to isolate and suppress substrate cracks according to manufacturer's written instructions.

1. Prepare and prefill substrate cracks with membrane material.
2. Install membrane at substrate cracks in areas to receive terrazzo.
3. Reinforce membrane with fiberglass scrim.

G. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

## 3.3 EPOXY-RESIN TERRAZZO INSTALLATION

A. Comply with NTMA's written recommendations for terrazzo and accessory installation.

B. Strip Materials:

1. Divider and Control-Joint Strips:

    a. Locate divider strips in locations necessary for patch and matching existing pattern.
    b. Install control-joint strips back to back and directly above concrete-slab control joints.
    c. Install control-joint strips with 1/4-inch gap between strips, and install sealant in gap.
    d. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.

2. Accessory Strips: Install as required to provide a complete installation and necessary for patch and matching existing pattern.

C. Apply primer to terrazzo substrates according to manufacturer's written instructions.

D. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions.

1. Installed Thickness: To match existing.
2. Terrazzo Finishing: Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.

    a. Rough Grinding: Grind with 24-grit or finer stones or with comparable diamond abrasives. Follow initial grind with 60/80-grit stones or with comparable diamond abrasives.
    b. Grouting: Before grouting, clean terrazzo with water, rinse, and allow to dry. Apply and cure epoxy grout.
    c. Fine Grinding/Polishing: Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted. Grind with 120-grit stones or with comparable diamond abrasives until grout is removed from surface.

3. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet; noncumulative.

E. Install and finish poured-in-place terrazzo stairs at the same time the adjacent terrazzo flooring is installed.

F. Install and finish poured-in-place terrazzo base at the same time the adjacent terrazzo flooring is installed.

## 3.4 REPAIR

A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

## 3.5 CLEANING AND PROTECTION

A. Cleaning:

1. Remove grinding dust from installation and adjacent areas.

2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.

B. Sealing:

1. Seal surfaces according to NTMA's written recommendations.
2. Apply sealer according to sealer manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION 096623

# SECTION 096813 - TILE CARPETING

## 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 modular, tufted carpet tile and rubber edging/nosing.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:

1. Carpet tile type, color, and dye lot.
2. Type of installation.
3. Pattern of installation.
4. Pattern type, location, and direction.
5. Pile direction.
6. Type, color, and location of insets and borders.
7. Type, color, and location of edge, transition, and other accessory strips.
8. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockups at locations as directed by the Architect, showing carpet tile color and pattern, and edgings.
2. 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. Comply with CRI 104.

1.9 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
3. Warranty Period: Lifetime from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Products: Subject to compliance with requirements, provide the following:

1. Milliken and Company.

B. Basis-of-Design Product: Subject to compliance with requirements, provide the following:

1. Milliken and Company, Landmark Collection.

C. Color: As selected by Architect from manufacturer's full range.

D. Pattern: Artifact; Vestige Certified Wear On.

E. Fiber Content: 100 percent nylon.

F. Fiber Type: Nylon Type 6,6.

G. Pile Characteristic: Tufted, textured loop.

H. Density: 6, 541.

I. Pile Thickness: 1.3 inch for finished carpet tile.

J. Total Weight: 15 oz./yd.

K. Primary Backing/Backcoating: Manufacturer's standard composite materials, PVC-Free Underscore ES Cushion – Traction Back.

L. Size: 39.4 x 39.4 inches (1m x 1m).

M. Applied Soil-Resistance Treatment: Manufacturer's standard material.

N. Antimicrobial Treatment: Manufacturer's standard material.

O. Performance Characteristics: As follows:

1. Appearance Retention Rating: Severe traffic, 3.5 minimum according to ASTM D 7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
3. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
4. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
5. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
6. Colorfastness to Light: Not less than 4 after 80 AFU (AATCC fading units) according to AATCC 16, Option E.
7. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
8. Emissions: Provide carpet tile that complies with testing and product requirements of CRI's "Green Label Plus" program.

## 2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Traction Back by Milliken.

C. Rubber Transition Strips: Provide preformed rubber transition strips between carpet tiles and other flooring materials as per carpet tile Manufacturer’s recommendation. Color to be selected from Manufacturer’s full range of colors.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. For wood subfloors, verify the following:

1. Underlayment over subfloor complies with requirements specified in Section 061000 "Rough Carpentry."
2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

## 3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

## 3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

# SECTION 099100 - PAINTING

## PART 1 - GENERAL

### 1.1 RELATED INFORMATION

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

B. Reference Finish Schedule for areas of accent color patterns and striping.

### 1.2 SUMMARY

A. This Section includes surface preparation and field painting of the following:

1. Exposed exterior items and surfaces.
2. Exposed interior items and surfaces.
3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
4. Paint exposed structure and mechanical ducts.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:

a. Architectural woodwork and casework.
b. Acoustical wall panels.
c. Finished mechanical and electrical equipment. (Except exposed duct work and grills/register)
d. Light fixtures.
e. Distribution cabinets.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a. Foundation spaces.
b. Furred areas.
c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.
f. Duct shafts.

3. Finished metal surfaces include the following:

a. Anodized aluminum.
b. Stainless steel.
c. Chromium plate.
d. Copper.
e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

a. Valve and damper operators.
b. Linkages.
c. Sensing devices.
d. Motor and fan shafts.

5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:

1. Division 2 Section "Portland Cement Concrete Paving" for traffic-marking paint.
2. Division 5 Section "Structural Steel" for shop priming structural steel.
3. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
4. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
5. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board.

E. Alternates: Refer to Division 1 Section "Alternates" for description of Work in this Section affected by alternates.

## 1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
4. Semi-gloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

## 1.4 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

B. Samples for color Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements Paint Manufacturer Specified for Quality is Sherwin Williams, which is the MSU constructed standard. Other products are required to provide information qualifying equal product to specified product. Items incorporated into the work by the following manufacturers provided they show compliance with Sherwin Williams product:

1. Sherwin Williams
2. ICI
3. Benjamin Moore
4. PPG

### 2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

1. DEVOE

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Match colors indicated by reference to manufacturer's color designations.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

## 3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

    a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
    b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
    c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

    a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling. All surfaces of wood are to be primed and sealed including non-exposed surfaces. All exposed surfaces are to be Primed, stained and sealed.
    c. When transparent finish is required, backprime with spar varnish.

d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

## 3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
10. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. Exposed Mechanical items to be painted include, but are not limited to, the following:

1. Piping, pipe hangers, and supports.
2. Ductwork.
3. Insulation.
4. Accessory items.

G. Electrical items to be painted include, but are not limited to, the following:

1. Conduit and fittings.

H. Structural items to be painted include, but are not limited to, the following:

1. Columns

2. Beams
3. Perlins
4. Exposed structural supports, hangers and miscellaneous

I. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

J. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

K. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

L. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

M. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

N. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

## 3.4 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:

1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:

a. Quantitative material analysis.
b. Abrasion resistance.
c. Apparent reflectivity.
d. Flexibility.
e. Washability.
f. Absorption.
g. Accelerated weathering.
h. Dry opacity.
i. Accelerated yellowness.
j. Recoating.
k. Skinning.
l. Color retention.
m. Alkali and mildew resistance.

3. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove non-complying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

## 3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

## 3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

## 3.7 EXTERIOR PAINT SCHEDULE: Sherwin Williams

As a standard at this schedule based on Sherwin Williams.

A. Concrete as Follows:
1. 1st Coat: Primer - A24W08300 Loxon® Concrete & Masonry primer, Interior/Exterior Latex.
2. 2nd Coat: Topcoat – A82W00151-A-100® Exterior Latex Stain.

B. Concrete Masonry Units (block) as follows:

1. 1st coat: Primer – B25W00025 - PrepRite® Inerior Latex Block Filler.
2. 2nd coat: Topcoat - Topcoat – A82W00151-A-100® Exterior Latex Stain.

C. Exterior Gypsum or Wood Soffit Board as follows:

1. 1st coat: Primer – B42W00041 – Exterior Latex Wood Primer.
2. 2nd coat: Topcoat – A82W00151-A-100® Exterior Latex Stain.

D. Ferrous Metal as follows:

1. 1st coat: Primer – B66W00001 – DTM Acrylic Primer/Finish.
2. 2nd coat: Topcoat - B66W01151 – Pro Industrial DTM Acrylic Semi-Gloss.

E. Zinc-Coated Metal as follows:

1. 1st Coat: Primer: B66W00310 – Pro Industrial Pro-Cryl® Universal Acrylic Primer.
2. 2nd Coat: Topcoat – B66W01151 – Pro Industrial DTM Acrylic Semi-Gloss.

F. Aluminum as follows:

1. Full-gloss, Acrylic Enamel: 2 coats over galvanized metal primer.
2. Full-Gloss, Alkyd Enamel: 2 coats over primer.

G. Traffic and zone marking paint:

1. Color: White.

3.8 INTERIOR PAINT SCHEDULE: Kelly-Moore/or Sherwinn Williams
As a standard at this schedule based on Kelly-Moore

A. Concrete Masonry Units (block not factory colored and finished), painted as follows:

1. 1st coat: Primer: B66W00025 - PrepRite® Interior/Exterior Latex Block filler.
2. 2nd coat:Topcoat – K45W00151 –Pro Industrial PreCatalyzed Waterbased Epoxy Eg-Shel.
3. 3rd coat:Topcoat - K45W00151 –Pro Industrial PreCatalyzed Waterbased Epoxy Eg-Shel.

B. Gypsum Board, ceilings as follows:

1. 1st coat: Primer – B28W02600 - ProMar® 200 Zero VOC Interior Latex Primer.
2. 2nd coat: Topcoat – K45W00151 – Pro Industrial PreCatalyzed Waterbased Epoxy Eg-Shel.

C. Gypsum Board, walls, Semi-Gloss Finish/Acrylic as follows:

1. 1st coat: Primer – B28W02600 - ProMar® 200 Zero VOC Interior Latex Primer.
2. 2nd coat: Topcoat – K45W00151 – Pro Industrial PreCatalyzed Waterbased Epoxy Eg Shel.

D. Woodwork and Hardboard as follows:

1. 1st coat: A49N00202 – Wood Classics® Interior Oil Stain.
2. 2nd coat: B26 V00043 – Wood Classics® Fast Dry Sanding Sealer Clerar.
3. 3rd coat: Finish A66F00390 – Wood Classics® Fast Dry Varnish Hand Rubbed Stain Clear.

E. Stained Woodwork as follows:

1. Alkyd-Based, Satin Varnish: 2 coats clear-satin varnish over sealer and wood stain.
2. Waterborne, Satin Varnish: 2 coats clear-satin varnish over sealer and wood stain.
3. Water-Based, Full Gloss, Varnish: 2 coats Full-Gloss varnish over sealer and wood stain.
4. Alkyd-Based Stain, Wax-Polished Finish: 3 coats paste wax over sealer and wood stain.

F. Natural-Finish Woodwork as follows:

1. Alkyd-Based, Stain Varnish: 2 coats clear-satin varnish over sealer.
2. Waterborne, Satin Varnish: 2 coats clear-satin varnish over sealer.
3. Water-Based, Full Gloss, Varnish: 2 coats Full-Gloss varnish over sealer.
4. Wax-Polished Finish: 3 coats paste wax over sealer.

G. Ferrous Metal as follows:

1. 1st coat: Primer – B66W00001 – DTM Acrylic Primer/Finish.
2. 2nd coat:Topcoat – K45W00151 – Pro Industrial PreCatalyzed Waterbased Epoxy Eg-Shel.

H. Zinc-coated Metal as follows:

1. Semi Gloss, Acrylic Enamel: Primer – B66W00310 – Pro Industrial Pro-Cryl® Universal Acrylic Primer.
2. Semi Gloss, Acrylic Enamel:Topcoat – B42W00001 – Pro Industrial PreCatalyzed Waterbased Epoxy Eg-Shel.

I. Insulated Ducts and Pipes

1. Topcoat: B42W00001 – Waterborne Acrylic Dry Fall Flat.

END OF SECTION 099100


AIA HPA
ARCHITECTS PROGRAMMERS PLANNERS

# FINISH SCHEDULE - BOLIN SCIENCE - 16782.00

| AREA | ROOM NAME | ROOM NO | FLR. | BASE | NORTH WALL | EAST WALL | SOUTH WALL | WEST WALL | CLG. FIN | CLG. HT. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1ST FLOOR:** | | | | | | | | | | | |
| AREA "B-1D" | VESTIBULE | 1VEST1 | 1A/1F | 2A/E | 3A | 3A | 3A | 3E/R2 | 4A | - | R1, R4 |
| | LECTURE HALL VESTIBULE | 1VEST2 | 1F | 2A/2D | 3B | 3B | 3B | 3B | 4D/R5 | | R1, R2,R5 |
| | | | | | | | | | | | |
| AREA "B-1C" | CORRIDOR | 1CORR4 | 1A | 2E | 3A/3E | 3E | 3E | - | 4D/R5 | | R5 |
| | CORRIDOR | 1CORR5 | 1A | 2A | 3E | 3E | 3E | 3A | 4B/R6 | | |
| | CORRIDOR | B101 | 1A | 2E | 3A | - | 3A/3E | 3E | 4A | | R2, R4 |
| | CORRIDOR | B102 | 1A | 2A/2E | 3A | 3A | 3A | 3E | 4A | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | WEST CORRIDOR | 1CORR1 | 1A | 2A/2E | 3A | 3A/3E | 3A | 3A/3E | 4D | | R5 |
| | CUSTODIAL | 1CUST2 | 1A | 2D | 3B | 3B | - | 3B | 4E | | R6 |
| | LECTURE HALL | 127 | R7/1A | 2D | - | 3B | - | - | 4E | | |
| | STORAGE | 127A | - | - | - | - | - | - | - | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | STAIRS | 1STRW1 | 1A | 2A/2E | 3A | 3E | - | 3A | R6 | | |
| | VESTIBULE | 1VEST2 | 1A | 2A/2D | 3B | 3B/R2 | 3B | 3B | 4E | - | R2 |
| | VESTIBULE | 1VEST3 | 1A/R3 | 2A/2D | 3A | 3B/R2 | 3B/R2 | 3A | R6 | - | R1, R2, R3, R6 |
| | VESTIBULE | 1VEST4 | 1A/R3 | 2A/2E | 3A | 3A | 3A | 3E | 4D | | R5 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| AREA "B-1B" | CORRIDOR | B103 | 1A | 2A | 3A/3E | 3A | 3A | 3A | 4A | | |
| | EAST CORRIDOR | 1CORR2 | 1A | 2A | 3A | 3A | 3A | 3A | 4A | | |
| | | | | | | | | | | | |
| | STORAGE | 1STOR3 | 1A/1F | 2D | 3B | 3B | 3B | 3B | 4B | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| AREA "B-1A" | CORRIDOR | 1CORR3 | 1G | 2E | 3E | 3E | 3E | 3E | 4B | | |
| | | | | | | | | | | | |
| | STORAGE/OFFICE | 117A | 1D | 2D | 3E | 3E | 3E | 3E | 4B | | |
| | STAIRS | 1STRW2 | 1G | 2C | 3E | 3E | 3E | 3E | 4E | | |
| | | | | | | | | | | | |
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# FINISH SCHEDULE - BOLIN SCIENCE - 16782.00

| AREA | ROOM NAME | ROOM NO | FLR. | BASE | NORTH WALL | EAST WALL | SOUTH WALL | WEST WALL | CLG. FIN | CLG. HT. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| **2ND FLOOR:** | | | | | | | | | | | |
| AREA "B-2A" | CORRIDOR | B201 | 1A | 2A/E | 3E/A | 3A | 3A | 3A | 4A | | |

# FINISH SCHEDULE - FERGUSON - MSU 16782.00

| AREA | ROOM NAME | ROOM NO | FLR. | BASE | NORTH WALL | EAST WALL | SOUTH WALL | WEST WALL | CLG. FIN | CLG. HT. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1ST FLOOR:** | CORRIDOR | 1CORR1 | 1A | 2A | 3A/R12 | 3A | 3A | 3A | 4A | | R12 |
| | CORRIDOR | 1CORR2 | 1A | 2A | 3A | 3A | 3A/R12 | 3A | 4A | | R12 |
| | CORRIDOR | 1CORR3 | 1A | 2A | 3A/R12 | 3A/R12 | 3A/R12 | 3A/R12 | 4A | | R12 |
| | | | | | | | | | | | |
| | WAITING | 105 | 1A | 2A | 3A | 3A | 3A/R12 | 3A/R12 | 4A | | R12 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **2ND FLOOR:** | STAIR | 2STRW1 | 1D | 2D | 3F | 3F | 3F | 3F | 4E | | |
| | STAIR | 2STRW2 | 1D | 2D | 3F | 3F | 3F | 3F | 4E | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| **3RD FLOOR:** | CORRIDOR | F301 | 1H | 2C | 3F | 3F | 3F | 3F | 4A/E | | R13, R14 |
| | | | | | | | | | | | |
| | WOMEN | 3RR1 | 1H | 2C | 3G | 3G | 3G | 3G | 4B | | R13 |
| | MEN | 3RR2 | 1H | 2C | 3G | 3G | 3G | 3G | 4B | | R13 |
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# FINISH SCHEDULE - FAIN FINE ARTS - MSU 16782.00

| AREA | ROOM NAME | ROOM NO | FLR. | BASE | NORTH WALL | EAST WALL | SOUTH WALL | WEST WALL | CLG. FIN | CLG. HT. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1ST FLOOR:** | | | | | | | | | | | |
| AREA "FF-1A" | MECH. | 1STOR1 | 1E | 2D | 3B | 3B | 3B | 3B | 4B | | |
| | LOBBY | 1LOBB1 | 1B | 2D | 3F | 3F | 3F | 3F | 4B | | |
| | STAIRS | 1STRW1 | 1B | 2D | 3F | 3F | 3F | 3F | 4B | | R24 |
| | ELEVATOR | 1ELEV1 | 1H | 2D | - | - | - | - | - | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | CORRIDOR | 1CORR1 | 1A | 2A | 3A | 3A | 3A | 3A | 4A | | |
| | CORRIDOR | 1CORR2 | 1A | 2D | 3F | 3F | 3F | 3F | - | | R29 |
| | THEATER OFFICE | B104 | 1D | 2D | 3F | 3F | 3F | 3F | 4A | | |
| | CLASSROOM | B105 | 1D | 2D | 3B | 3B | 3B | 3B | 4B | | R14 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | OFFICE | B107 | - | - | - | - | - | - | - | | |
| | OFFICE | B108 | - | - | - | - | - | - | - | | |
| | OFFICE | B109 | - | - | - | - | - | - | - | | |
| | OFFICE | B110 | - | - | - | - | - | - | - | | |
| | OFFICE | B111 | - | - | - | - | - | - | - | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | CORRIDOR | FFA101 | 1B | 2D | 3B | 3B | 3B | 3B | 4B | | R14 |
| | CUSTODIAL | 1CUST1 | - | - | - | - | - | - | - | | |
| | MENS | 1RR2 | 1H | 2C | 3G | 3G | 3G | 3G | 4B | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| AREA "FF-1B" | GREEN ROOM | B116 | - | - | - | - | - | - | - | | |
| | THEATER STAGE | B117 | 1A | 2A | 3A | 3A | 3A | 3A | 4A | | R19, R26 |
| | STUDIO/THEATER | B118 | 1A | 2A | 3A | 3A | 3A | 3A | 4A | | R19 |
| | CORRIDOR | 1CORR3 | - | - | - | - | - | - | - | | |
| | | | | | | | | | | | |
| | CLASSROOM | B120 | - | - | - | - | - | - | - | | |
| | STORAGE | B121A | - | - | - | - | - | - | - | | |
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# FINISH SCHEDULE - FAIN FINE ARTS - MSU 16782.00

| AREA | ROOM NAME | ROOM NO | FLR. | BASE | NORTH WALL | EAST WALL | SOUTH WALL | WEST WALL | CLG. FIN | CLG. HT. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| AREA "FF-1C" | PAINT ROOM | B122 | - | | | | | | | | |
| | OFFICE | B123 | - | | | | | | | | |
| | TOOL ROOM | B124B | 1A | 2D | 3F | 3F | 3F | 3F | 4A | | |
| | PLATFORM LIFT | | 1E | - | 3F | 3F | 3F | 3F | - | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| AREA "FF-1D" | VEST | FFA102 | 1A | 2D | 3F | 3F | 3F | 3F | 4E | | R14 |
| | CORRIDOR | FFA103 | 1A | 2D | 3F | 3F | 3F | 3F | 4E | | R20 |
| | LOBBY | FFA104 | 1I | 2B | 3H | 3H | 3H | 3H | 4A | | R20 |
| | MENS LOUNGE | FFA105 | 1A/1C | 2A | 3F | 3F | 3F | 3F | 4E | | |
| | SEATING AREA | FFA106 | 1I /1C | 2B | 3H | 3H | 3H | 3H | 4A | | R27 |
| | LOUNGE | FFA107 | 1A | 2A | 3F | 3F | 3F | 3F | 43 | | R27, R28 |
| | WOMENS LOUNGE | FFA108 | 1C | 2A | 3F | 3F | 3F | 3F | 4E | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | LOBBY | FFA109 | 1I | 2B | 3H | 3H | 3H | 3H | 4A | | R20 |
| | CORRIDOR | FFA110 | 1A | 2D | 3F | 3F | 3F | 3F | 4E | | R20 |
| | VEST | FFA111 | 1A | 2D | 3F | 3F | 3F | 3F | 4E | | R14 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| AREA "FF-1E" | CUSTODIAN | 1CUST2 | - | - | - | - | - | - | - | | |
| | WOMENS | 1RR5 | 1H | 2C | 3G | 3G | 3G | 3G | 4B | | R29 |
| | MENS | 1RR6 | 1H | 2C | 3G | 3G | 3G | 3G | 4B | | R29 |
| | FOYER | | - | - | - | - | - | - | - | | |
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# FINISH SCHEDULE - FAIN FINE ARTS - MSU 16782.00

| AREA | ROOM NAME | ROOM NO | FLR. | BASE | NORTH WALL | EAST WALL | SOUTH WALL | WEST WALL | CLG. FIN | CLG. HT. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| **2ND FLOOR:** | | | | | | | | | | | |
| AREA "FF-2A" | LOBBY | 2LOBB1 | 1B | 2D | 3F | 3F | 3F | 3F | 4B | | |
| | ELEC. | 2STOR1 | 1E | 2D | 3B | 3B | 3B | 3B | 4B | | |
| | STAIRS | 2STRW1 | 1B | 2D | 3F | 3F | 3F | 3F | 4B | | R24 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | CORRIDOR | 2CORR1 | 1A/1B | 2D | 3F | 3F | 3F | 3F | 4D | | R5 |
| | CORRIDOR | FFA201 | 1B | 2D | 3B | 3B | 3B | 3B | 4D/R5 | | R5, R14, R30 |
| | VEST | FFA202 | 1B | 2D | 3B | 3B | 3B | 3B | 4D/R5 | | R5, R14, R30 |
| | | | | | | | | | | | |
| | STAIR | FFA203 | 1A | 2A | 3F | 3F | 3F | 3F | 4A | | |
| | OFFICE | FFA204 | - | - | - | - | - | - | - | | |
| | COSTUME FITTING RM | FFA205 | - | - | - | - | - | - | - | | |
| | STORAGE | 2STOR2 | 1A/2B | 2D | 3B | 3B | 3B | 3B | 4E | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | UTILITY | B210 | 1A | 2A | 3F | 3F | 3F | 3F | 4A | | |
| | MAKEUP A | B211 | 1A | 2A | 3F | 3F | 3F | 3F | 4D | | |
| | DRESSING A | B211A | 1A | 2A/R2 | 3A | 3A/3E | 3A/3E | 3A/3E | 4E | | R31 |
| | MAKEUP B | B214 | 1A | 2A | 3F | 3F | 3F | 3F | 4D | | |
| | DRESSING B | B214A | 1A | 2A/R2 | 3A/3E | 3A/3E | 3A | 3A/3E | 4E | | R31 |
| | | | | | | | | | | | |
| AREA "FF-2B" | STORAGE | B208 | 1A | 2A | 3F | 3F | 3F | 3F | 4A | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| AREA "FF-2C" | OFFICE | B209 | 1A | 2A | 3F | 3F | 3F | 3F | 4A/R5 | | R5 |
| | CORRIDOR | 2CORR2 | 1A | 2A | 3F | 3F | 3F | 3F | - | | |
| | PLATFORM LIFT | | | | | | | | | | R24 |
| | STAIR | | | | | | | | | | R24 |
| | | | | | | | | | | | |
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# FINISH SCHEDULE - HARDIN - MSU 16782.00

| AREA | ROOM NAME | ROOM NO | FLR. | BASE | NORTH WALL | EAST WALL | SOUTH WALL | WEST WALL | CLG. FIN | CLG. HT. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AREA "H-1A" | CORRIDOR | 1CORR1 | 1D | 2D | 3F | 3F | 3F | 3F | 4A | | R14 |
| | CORRIDOR | 1CORR2 | 1C | 2F | - | - | - | - | 4E | | R15, R16, R17, R20, R21, R22 |
| | CORRIDOR | 1CORR4 | 1C | 2F | - | - | - | - | 4E | | R15, R16, R17, R20, R21, R22 |
| | CORRIDOR | 1CORR5 | 1A | - | - | R18 | - | - | - | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | STAIRS | 1STRW7 | - | - | - | - | - | - | - | | R19 |
| | STAIRS | 1STRW8 | - | - | - | - | - | - | - | | R19 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | ROOM/LOADING | HN-102 | - | - | - | - | R18 | - | R19 | | R19 |
| | 1CUST1 | HN-102A | - | - | - | - | - | - | - | | |
| | | | | | | | | | | | |
| | WOMENS DRESSING | HN-103 | 1D | 2D | 3B | 3B | 3B | 3B | 4B | | R14 |
| | TOILET | HN-103A | 1H | 2C | 3G | 3G | 3G | 3G | 4B | | R14 |
| | | | | | | | | | | | |
| | MENS DRESSING | HN-104 | 1D | 2D | 3B | 3B | 3B | 3B | 4B | | R14 |
| | TOILET | HN-104A | 1H | 2C | 3G | 3G | 3G | 3G | 4B | | R14 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | STOR | HN-105A | 1D | 2D | 3B | 3B | 3B | 3B | 4B | | R14 |
| | STOR | HN-106 | 1D | 2D | 3B | 3B | 3B | 3B | 4B | | R14 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | AKIN AUDITORIUM | HN-108 | - | - | - | - | - | - | R19 | | R19 |
| | | | | | | | | | | | |
| AREA "H-1B" | 1CUST3 | HN-108A | - | - | - | - | - | - | - | | |
| | LOBBY | 1CORR3 | 1A/1F | 2A/2G | 3F | 3F | 3F | 3F | 4E | | R14, R23 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | STAIRS | 1STRW6 | 1A | 2A | 3F | 3F | 3F | 3F | 4E | | R14, R24 |
| | | | | | | | | | | | |
| | TOILET | 1RR5 | 1D | 2C | 3G | 3G | 3G | 3G | 4B | | R23, R25 |
| | TOILET | 1RR6 | 1D | 2C | 3G | 3G | 3G | 3G | 4B | | R23 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| AREA "H-1D" | CORRIDOR | H101 | 1A | 2A | - | - | - | - | - | | R20 |
| | | | | | | | | | | | |
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# FINISH SCHEDULE - HARDIN - MSU 16782.00

| AREA | ROOM NAME | ROOM NO | FLR. | BASE | NORTH WALL | EAST WALL | SOUTH WALL | WEST WALL | CLG. FIN | CLG. HT. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
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| **2ND FLOOR:** | | | | | | | | | | | |
| AREA "H-2A" | MECHANICAL | HN-204 | - | - | - | - | - | - | - | - | R19 |
| | MECHANICAL | HN-204A | - | - | - | - | - | - | - | - | R19 |
| | MECHANICAL | HN-204B | - | - | - | - | - | - | - | - | R19 |
| | MECHANICAL | HN-204C | - | - | - | - | - | - | - | - | R19 |
| | MECHANICAL | HN-204D | - | - | - | - | - | - | - | - | R19 |
| | MECHANICAL | HN-204E | - | - | - | - | - | - | - | - | R19 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | STAIRS | 2STRW7 | - | - | - | - | - | - | - | - | R19 |
| | STAIRS | 2STRW8 | - | - | - | - | - | - | - | - | R19 |
| | STAIRS | 2STRW9 | - | - | - | - | - | - | - | - | R19 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | SHAFT | 2CHS1 | - | - | - | - | - | - | - | - | R19 |
| | SHAFT | 2CHS2 | - | - | - | - | - | - | - | - | R19 |
| | SHAFT | 2CHS4 | - | - | - | - | - | - | - | - | R19 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | STO/CLO. | HN-201A | - | - | - | - | - | - | - | - | R19 |
| | STO/CLO. | HN-203 | - | - | - | - | - | - | - | - | R19 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | DRESSING ROOM | HN-201 | - | - | - | - | - | - | - | - | R19 |
| | DRESSING ROOM | HN-202 | - | - | - | - | - | - | - | - | R19 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| AREA "H-2B" | CUST | HA-2CUST1 | - | - | - | - | - | - | - | - | |
| | MEN | 2RR4 | 1H | 2D | 3G | 3G | 3G | 3G | 4B | | |
| | TOILET VESTIBULE | 2RR4A | 1F | 2E | 3F | 3F | 3F | 3F | 4E | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| AREA "H-2C" | VESTIBULE | 2VEST1 | 1F | 2E | 3G | 3G | 3G | 3G | 4B/4E | | |
| | WOMEN | 2RR3 | 1H | 2D | 3G | 3G | 3G | 3G | 4B | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

# FINISH SCHEDULE KEY

**1. FLOORS**

- **1A.** Existing Floor Finish to Remain.
- **1B.** Polished Exposed Stained Concrete - Sealed.
- **1C.** Carpet Tiles.
- **1D.** 12”x12” Vinyl Composition Tile.
- **1E.** Exposed Concrete – Sealed.
- **1F.** Terrazzo – Patch – infill – Match Existing.
- **1G.** Terrazzo Tile 4’ x 4’.
- **1H.** 12” x 12” Ceramic Tile
- **1I.** Brick/Pea Gravel Concrete

**2. BASE**

- **2A.** Existing Base to remain.
- **2B.** Brick
- **2C.** Cove Base – Ceramic Tile.
- **2D.** 4”H. Rubber Cove Base.
- **2E.** Terrazzo Base – Rolled up wall – Match Existing.
- **2F.** Paint 1/4 Round stained wood.
- **2G.** Repair and fill 6” (watch existing profile and size and shape).

**3. WALLS**

- **3A.** Existing Wall Finish to remain.
- **3B.** Gypsum Board – Texture & Paint.
- **3C.** Ceramic Tile, 4” x 4”.
- **3D.** Existing Face Brick and/or Cast Stone work to remain.
- **3E.** Mosaic Ceramic Tile 2’ x 2’ – Match Existing – Pattern around door with a minimum 3 color pattern.
- **3F.** Paint
- **3G.** 12” x 12” Ceramic Tile with Accent Tile.
- **3H.** Brick

**4. CEILING:**

- **4A.** Existing Ceiling to remain.
- **4B.** 2’ x 2’ Lay-in Suspended Acoustical Ceiling in new painted steel grid with 3½” batt insulation above.
- **4C.** Exposed Roof Structure - paint.
- **4D.** New 2’ x 2’ Ceiling Tiles in an existing 2’ x 2’ lay-in Suspended Acoustical Grid.
- **4E.** Gyp. Board Ceiling – Paint.

**REMARKS**

- **R1.** All finishes in this area are to remain any repaired or infilled area during construction shall match existing as closely as possible.
- **R2.** Infill areas from removed doors, or closed in areas to make new openings are to match adjacent as closely as possible.
- **R3.** Provide Aluminum Saddle threshold over opening between room and corridor at new wall.
- **R4.** Build drywall around new opening up to new header and recessed ceiling.

**R5.** Extend ceiling grid into new opening area match existing – repair as necessary to allow for new construction.
**R6.** Patch drywall ceiling – Paint ceiling of area to extent of continuous surface.
**R7.** Only work in this room is the east wall associated with new openings and wall infill.
**R8.** Match existing ceramic tile wainscot at door infill.
**R9.** Modify cabinetry to allow for new door width finish end of existing cabinet to match existing.
**R10.** Repair existing ceiling tile as necessary, or, if damaged in construction of new doors.
**R11.** Build new drywall header over existing door area to enclose transom above door. Match width of existing wall with studs and drywall. Tape, bed and texture to match – Paint.
**R12.** Paint new wood trim at door frames where door has been removed.
**R13.** Remove Ceramic tile off walls and floor. Prepare all surfaces for new finishes, floors, walls and ceilings.
**R14.** Provide corner guards on all drywall corners (Stained or Painted to match existing in adjacent areas.)
**R15.** New Carpet around the auditorium seating, but not under seats, replacing existing carpeted area.
**R16.** Provide 1/4 round wood trim; Base – Stained around and coordinated with LED Strip Egress Low Level lighting at base in auditorium aisles and ramps; coordinate with stair risers and treads.
**R17.** Stained wood trim handrails.
**R18.** Protect all existing finishes in this area, paint conduit to match door, frame and wall for power operation for door.
**R19.** Only work in this area relates to fire suppression. PAINT all exposed piping and touch up all areas of walls and ceilings damaged by installation of piping system.
**R20.** Provide wood stained hand rail along the ramp and/or stairs.
**R21.** Provide Velvet Crowd Control Stanchion Rope with Brass Clasp equal to “Displays 2GO #RP2MRRBR03”.
**R22.** Provide Carpet Stair Treads and risers with wood trim – stained to match existing wool.
**R23.** Provide marble threshold at door into Toilet.
**R24.** Paint Guard Rail at stair.
**R25.** Black-Out window before enclosing with drywall.
**R26.** Paint trim and hand rails around new stair to under-stage.
R27. Cushions for seating areas are to match existing size and style; Cover all cushions throughout this area with new fabric specified, for seats and backs.
R28. Paint exposed structure and new Curtain Wall Window area.
R29. Remove vinyl off wall; size wall and prepare wall for new finish.
R30. Patch and stain floor to match adjacent flooring where walls have been removed and around new openings.
R31. New 2” x 2” Tile at shower and surrounding area to match existing as closely as possible with a pattern on walls and floors to blend.

END OF SECTION 099990

# SECTION 101550 - TOILET COMPARTMENTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes toilet compartments and screens as follows:

1. Type: Seamless solid plastic.
2. Compartment Style: Both overhead braced and floor anchored with Institutional Hardware (vandal resistant) are required for this Project. Each building will require “matching to existing”. The Contractor is to field verify. Information provided is a basis for bidding. Further information will be determined should a change be required.
3. Screen Style: Wall hung with Institutional Hardware (vandal resistant).

B. Related Sections include the following:

1. Division 10 "Toilet and Bath Accessories" for toilet paper holders, grab bars, purse shelves, and similar accessories.

### 1.3 SUBMITTALS

A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other work. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.

C. Samples: Manufacturer's color charts consisting of sections of actual units showing the full range of colors, textures, and patterns available for each type of compartment or screen indicated.

### 1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

B. Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet partitions and related work; coordinate delivery with other work to avoid delay.

1.5 WARRANTY

A. Provide manufacturer's standard 15-year warranty against breakage, corrosion and delamination.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Comptec Industries / Capitol Partitions
2. Bobrick Washroom Equipment, Inc.
3. Ampco Products, Inc.
4. Tex-Lam Mfg., Inc.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Comptec Industries / Capitol Partitions, Evertuff Series, Solid Plastic with Institutional Hardware. The institutional hardware shall include, but not be limited to, the following:
2. Continuous gravity close hinges at doors (full height); 16 gauge.
3. Continuous U-channels for panel to stile mounting (full height); 18 gauge.
4. Continuous U-channels for panel to wall mounting (full height); 18 gauge.

2.2 PARTITION STYLE

A. Bolin: None required.
B. Ferguson: Floor mount *
C. Fain Fine Arts: Ceiling Hung.
D. Hardin Administration: Floor mounted and ceiling for areas with low ceilings.
*The ultimate desire of MSU is to have ceiling hung partitions if blocking above ceiling is available or possible.

2.3 MATERIALS

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.

B. Core Material: Manufacturer's standard recyclable high density polyethylene (HDPE) resins in thicknesses required to provide minimum nominal thicknesses for components as follows:

1. Doors, Panels, and Screens: 1 inch (25 mm) with ¼ inch radius rounded edge.
2. Pilasters: 1 inch (25 mm) with ¼ inch radius rounded edge.
3. Colors as selected by the Architect from Manufacturer's full range of colors in the "Classics" or "Impressions" color lines.

C. Concealed Anchorage Reinforcement: Minimum 12-gauge galvanized steel sheet.

D. Concealed Tapping Reinforcement: Minimum 14-gauge galvanized steel sheet.

E. Pilaster Shoes and Sleeves (Caps): ASTM A 167, Type 302/304 stainless steel, not less than 3 inches (75 mm) high, 20 gauge, finished to match hardware.

F. Stirrup Brackets: Manufacturer's institutional design for attaching panels and screens to walls and pilasters of the following material:

1. Material: Stainless steel.

G. Full-Height (Continuous) Brackets: Manufacturer's institutional design for attaching panels and screens to walls and pilasters of the following material:

1. Material: Stainless steel.

H. Hardware and Accessories: Manufacturer's institutional design, heavy-duty operating hardware and accessories of the following material:

1 Material: Stainless steel.

I. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with anti-grip profile in manufacturer's standard finish. Also provide headrails at the ends of partitions, bracing from the head rail at the front of the partition extending perpendicular to the nearest adjacent wall.

J. Heat-Sink Strip: Manufacture's standard continuous, extruded-aluminum strip, anti-grip profile with clear anodized finish.

K. Anchorages and Fasteners: Manufacturer's institutional exposed fasteners of stainless, finished to match hardware, with theft-resistant-type heads and nuts. For concealed anchors, use hot-dip galvanized, cadium-plated, or other rust-resistant, protective-coated steel.

## 2.3 FABRICATION

A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system, unless otherwise indicated. Provide units with cutouts, drilled holes, and internal reinforcement to receive compartment-mounted hardware, accessories, and grab bars, as indicated. All connections shall be through bolted with vandal resistant bolts to match other hardware.

B. Doors, panels, pilasters, and screens shall be 1" thick constructed from High Density Polyethylene (HDPE) resins. Partitions shall be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self- lubricating surface that resists marks from pens, pencils, markers and other writing instruments. All plastic components shall be covered with a protective plastic masking. All edges shall be rounded to ¼" radius.

C. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

D. Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

E. Doors: Unless otherwise indicated, provide 24-inch wide in-swinging doors for standard toilet compartments and 36-inch wide out-swinging doors with a minimum 32-inch wide clear opening for compartments indicated to be handicapped accessible, each with Institutional Hardware continuous (full height); 16-gauge.

1. Hinges: Self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.

2. Latch and Keeper: Recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories. Provide one (1) coat hook at each toilet compartment.
4. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
5 Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.
6 Mounting: Continuous U-channel (full height) 18-gauge for panel to stile mounting and panel to wall mounting.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch between pilasters and panels and not more than 1 inch between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

1. Secure panels to walls and panels with not less than 2 stirrup brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

B. Floor-Anchored Compartments: Set pilaster units with anchors penetrating not less than 2 inches (50 mm) into structural floor, unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

C. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

### 3.2 ADJUSTING AND CLEANING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.

B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 101550

# SECTION 102600 – ALUMINUM CORNER GUARDS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Reference Finish Schedule for Locations

B. Reference Architectural Drawings and Floor Plan Key Notes for Locations.

### 1.2 SUMMARY

A. Corner guard system for wall protection

### 1.3 SECTION INCLUDES

A. Aluminum Corner Guard Systems

### 1.4 SUBMITTALS

A. Product data for each type of corner guard specified.
B. Detail drawings indicating mounting details with the appropriate fasteners for specific project substrates.

C. Samples for verification purposes of corner guard, 6" (152mm) long, in full size profiles of each type and color indicated.
D. Cleaning and maintenance instructions for door and wall protection systems.

### 1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in unopened factory packaging to the jobsite and store in original packaging in a climate controlled location away from direct sunlight.

### 1.6 PROJECT CONDITIONS

A. Products must be installed in an interior climate controlled environment.

### 1.7 WARRANTY

A. Standard IPC Limited Lifetime Warranty against material and manufacturing defects.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

A. Acceptable Manufacturer or equal:

1. IPC Door and Wall Protection Systems,
InPro Corporation, PO Box 406 Muskego, WI 53150 USA;
Telephone: 800-222-5556, Fax: 888-715-8407,
Internet address: http://www.inprocorp.com

B. Provide all corner guards and wall protection from a single source.

2.2 MANUFACTURED UNITS

A. Corner Guards

1. Aluminum Corner Guards
2. Model: A675
3. Size: 3 ” x 3” x 1/8” radius x .080” thick.
4. Full Wall – Reference Finish Schedule for ceiling heights.
5. Materials: Aluminum.
6. Attachment and Fasteners: Pre-drilled beveled holes and Phillips head screws.
7. Finish: Selected from Full Range of Finishes available – Architect to select.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions in which the corner guard systems will be installed.

1. Complete all finishing operations, including painting, before beginning installation of corner guards.

B. Wall surface shall be dry and free from dirt, grease and loose paint.

3.2 PREPARATION

A. General: Prior to installation, clean substrate to remove dust, debris and loose particles.

3.3 INSTALLATION

A. General: Locate the corner guard as indicated on the approved detail drawing for the appropriate substrate and in compliance with the IPC installation instructions. Install corner guard level and plumb at the height indicated on the drawings.

B. Installation of Aluminum Corner Guards:

1. Surface must be dry, clean and properly sealed.
2. Screw on: Position the corner guard on the wall and attach it using the supplied screws.
3. Remove the protective plastic covering from the exposed surface of the corner guard.

3.4 CLEANING

A. General: At completion of the installation, clean surfaces in accordance with the IPC clean up and maintenance instructions.

END OF SECTION 102600

SECTION 104250 - SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following types of signs:

1. Individual Room Panel signs
2. Each building will need to “match existing” Room Signs as closely as possible. Contractor will need to field verify location and style of existing signs.

1.3 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

C. Shop drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.

1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.

1.4 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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:

1. Manufacturers of Panel Signs:

a. APCO Graphics, Inc.

2.2 MATERIALS

A. Photo Polymer sheet consisting of minimum 0.032 inch thick moisture resistant, non-glare nylon polymer on ultraviolet resistant clear PETS sign base, single piece construction. Thickness shall be 1/8 inch with color to be selected from Manufacturer's full range of colors.

B. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.3 PANEL SIGNS

A. Panel Signs: Fabricate signs by photo polymer process using film negatives to produce characters and graphics in contrasting color, raised 1/16 inch.

1. Signs shall be ADA and TAS compliant.

B. Characters:

1. Height: 5/8 inch.
2. Style: Sans Serif Style to match existing, upper case.
3. Width to Height Ratio: Between 3:5 and 1:1.
4. Stroke width to Height Ratio: Between 1:5 to 1:10.

C. Provide Braille indications for each other.

D. Corners: Square

E. Edges: Square.

F. Changeable Slide Inserts: Polycarbonate cover with slot behind for insertion of changeable slide strip removed from side.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions and according to ADA / TAS compliant heights.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided waterproof, pressure sensitive foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

3.3 Schedule: Equal to APCO IM System (Braille on All Signs) Match Existing Style of each building..

A. Class Room:

1. Size: 6 x 12 inches
2. Content: Room Number and changeable slide strip.
3. Quantity: 9

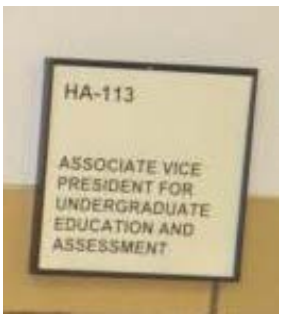
B. Offices; Storage; other
1. Size: 6 x 9 inches.
2. Content: Room number and changeable slide strip.
3. Quantity: 16

C. Toilet Rooms
1. Size: 6 x 9
2. Content: Toilet Gender Pictorial
3. Quantity: Male (6); Women (6); Unisex (1) Handicapped; Unisex (1) Non-Handicapped.

D. Pictorial Stair or Egress Direction
1. Size: 6 x 9
2. Content: Picture of Stair Exit; or Direction to Exit
3. Stairs: 8
4. Exit: 20

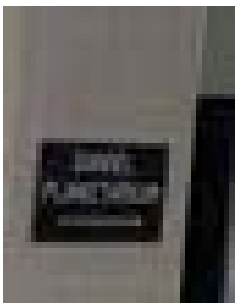
END OF SECTION 104250


Ferguson




Hardin


Fain Fine Arts



Bolin

Typical Signs


AIA HPA
ARCHITECTS PROGRAMMERS PLANNERS

SECTION 104413 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.
2. Fire-protection cabinets for the following:
   a. Portable fire extinguishers.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.

1. Fire Extinguishers: Include rating and classification.
2. 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.
3. Show location of knockouts for hose valves.

B. Samples for Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of cabinet finish indicated.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide extinguishers listed and labeled by FM.

1.5 COORDINATION

A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers indicated and provided by Owner under separate Contract are accommodated.

B. Coordinate size of cabinets to ensure that type and capacity of hoses, hose valves, and hose racks indicated are accommodated.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Portable Fire Extinguishers:

a. J.L. Industries, Inc.
b. Larsen's Manufacturing Company.

2. Fire-Protection Cabinets:

a. J.L. Industries, Inc.
b. Larsen's Manufacturing Company.

B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in the Fire-Protection Cabinet Schedule at the end of Part 3.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Type: J.L. Industries “COSMIC 10E”, or equal, multipurpose dry chemical type consisting of heavy-duty steel cylinder, rugged metal valve and siphon tube, replaceable molded valve stern seal, pull pin and upright squeeze-grip operation.

C. Rating: UL 4A-60BC, 10 lbs. Capacity, approved to -65°F, nontoxic.

D. Color/Finish: Factory-applied red epoxy, corrosion and impact resistant.

2.4 FIRE-PROTECTION CABINETS

A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

1. Cabinet Metal: Enameled-steel sheet.
2. Shelf: Same metal and finish as cabinet.
3. Fire-rated for 1-hr. or 2-hr. firewall applications (where indicated in Fire-Protection Cabinet Schedule).

B. Cabinet Type: Suitable for the following:

1. Type: J.L. Industries Ambassador 3036G11FX, or equal, # 6 satin stainless return trim, fire extinguisher cabinet with flanged tub constructed of cold-rolled steel.
2. Letters: Die cut letters in white

C. Cabinet Mounting: Suitable for the following mounting conditions:

1. Recessed: Cabinet box recessed in walls of shallow depth to suit style of trim indicated.

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

a. Rolled Edge: 2 ½" – maximum 4" deep rough opening.

E. Cabinet Trim Material: Manufacturer's standard, Same metal and finish as door.

F. Door Material: Manufacturer's standard Steel sheet.

G. Door Glazing: Manufacturer's standard, as follows:

1. Tempered Float Glass: Class 1 (clear) ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, as follows:

H. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

I. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

## 2.5 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.

1. Provide brackets for extinguishers not located in cabinets.
2. Brackets: J.L. Industries Mark Bracket MB846 of steel construction capable of supporting fire extinguishers under severe vibration conditions, with factory-applied red enamel finish.
3. Fasteners: Types and sizes recommended by fire extinguisher manufacturer to suit intended installations.

B. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.

. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.

a. Application Process: Silk-screened.
b. Lettering Color: Selected by Architect
c. Orientation: Vertical.

## 2.6 COLORS AND TEXTURES

A. Colors and Textures: As selected by Architect from manufacturer's full range for these characteristics.

## 2.7 FINISHES, GENERAL

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: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Cabinet and Door Finishes: Provide manufacturer's standard baked-enamel paint for the following:

1. Exterior of cabinets and doors, except for those surfaces indicated to receive another finish.
2. Interior of cabinets and doors.

E. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's specifications for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of 1.5 mils, medium gloss.
2. Color: As selected by Architect from manufacturer's full range.

2.8 STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

B. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.

1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi recessed cabinets are to be installed.

B. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
2. Fasten mounting brackets to structure and cabinets, square and plumb.
3. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

3.4 FIRE-PROTECTION CABINET SCHEDULE

A. Fire-Protection Cabinet FEC: Where this designation is indicated, provide seven (7) fire-protection cabinets and fire extinguishers complying with the following:

1. Products: As Specified in 2.4.
2. Construction: Nonrated.
3. Cabinet Material: Enameled-steel sheet
4. Type: Fire extinguisher shall be MP10 or equal
5. Mounting: Recessed
6. Trim Style: Exposed

    a. Exposed Trim: 2-½" Rolled Edge

7. Cabinet Trim Material: Steel sheet
8. Door Material: Steel sheet
9. Door Glazing: 1/8" thick Tempered float glass
10. Door Style: Vertical Duo
11. Accessories: Mounting brackets; Identification lettering.
12. Color and Texture: As selected by Architect from manufacturer's full range.

    a. Steel Finish: Baked enamel.

3.5 FIRE EXTINGUISHER SCHEDULE

A. Fire extinguisher FE: where this designation is indicated, provide twelve (12) fire extinguishers complying the following (5 in addition to those provided with cabinets specified in schedule above):

1. Products: As specified in 2.3.
2. Construction: Enameled-steel container
3. Location: Location and mounting height as directed by Architect.
4. Surface mounting bracket by extinguisher manufacturer.

END OF SECTION 10520

# SECTION 108010 - TOILET AND BATH ACCESSORIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Toilet and bath accessories.

B. Related Sections include the following:

1. Division 10 Section "Toilet Compartments" for compartments and screens.

### 1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

D. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

### 1.4 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.

1. Other manufacturers' products with equal characteristics may be considered. See Division 1 Section "Substitutions."

### 1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.

1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering accessories that may be incorporated into the Work include, but are not limited to, the following:

1. Toilet and Bath Accessories:

a. American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.
d. McKinney/Parker Washroom Accessories Corp.

B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Toilet and Bath Accessory Schedule at the end of Part 3.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.

C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

F. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

G. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

H. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.

1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.

E. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:

1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

F. Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 TOILET AND BATH ACCESSORY SCHEDULE

A. Grab Bar: Where this designation is indicated, provide stainless-steel grab bar complying with the following:

1. Products: Available products include the following:
   At each “handicapped" accessible watercloset location:
   a. Bobrick 68061 x 48 @ sidewall.
   b. Bobrick 68061 x 36 @ backwall.

   At each “roll-in handicapped accessible” shower stall:
   a. Bobrick B68061 x 51”, plus one at rear wall
   b. Bobrick B6806 x 30, two at side walls

2. Stainless-Steel Nominal Thickness: Minimum 0.05 inch.

3. Mounting: Concealed “S” Type with manufacturer's standard anchor plate flanges, concealed anchors, and snap flange.

4. Gripping Surfaces: Manufacturer's standard slip-resistant.

5. Outside Diameter: 1–½”

6. Stand off from wall: 1–½“

B. Mirror Unit: Where this designation is indicated, provide mirror unit complying with the following:

1. Products: Available products include the following: Bobrick #B165 Series
2. Stainless-Steel, Channel-Framed Mirror: Fabricate frame from stainless-steel channels in manufacturer's standard satin or bright finish with square corners mitered to hairline joints and mechanically interlocked.

3. Location:
   a. Above each lavatory or individual hand wash sink - #B165 (Reference Architectural Elevations for sizes).
   b. At each wash area.

C. Toilet Tissue and Paper Towel Holder: Furnished by Owner and installed by the General Contractor.

D. Soap Dispenser: Furnished by Owner and installed by the General Contractor.

E. Feminine Napkin Disposal

1. Provide (1) unit at each toilet stall in Women’s Toilets.
2. Product Equal to Bobrick B-354; Partition mounted Sanitary Napkin Disposal.

END OF SECTION 108010

# SECTION 125110 - HORIZONTAL LOUVER BLINDS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

B. Reference Opening Schedule on Architectural Sheet A501 for locations.

### 1.2 SUMMARY

A. This Section includes horizontal louver blinds.

### 1.3 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 each type of horizontal louver blind specified. Include printed data on physical characteristics.

C. Shop drawings showing location and extent of blinds. Show installation details at and relationship to adjoining work. Include elevations indicating blind units. Indicate location of blind controls.

D. Samples for selection purposes, in manufacturer's standard sizes, showing the full range of color, texture, and pattern variations expected. Prepare samples from the same material to be used for the Work.

E. Schedule of horizontal louver blinds using same room designations indicated on Drawings.

F. Maintenance data for horizontal louver blinds to include in the operation and maintenance manual specified in Division 1. Include the following:

1. Methods for maintaining horizontal louver blinds and finishes.
2. Precautions for cleaning materials and methods that could be detrimental to finishes and performance.

### 1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide horizontal louver blinds identical to those tested for the following fire-test-response characteristics as determined by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Test Method: NFPA 701.
2. Rating: Pass.

B. Single-Source Responsibility: Obtain each type of horizontal louver blind from one source and by a single manufacturer.

1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual horizontal louver blind dimensions by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Enclosure and Environmental Limitations: Do not install horizontal louver blinds until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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:

1. Horizontal Louver Blinds:

a. Hunter Douglas, Inc.
b. Kirsch.
c. Levolor Corp.

B. Available Products: Subject to compliance with requirements, horizontal louver blinds that may be incorporated in the Work shall be equal to the following:

1. Hunter Douglas – Parkland Textures.

2.2 HORIZONTAL LOUVER BLINDS

A. Louvers: Manufacturer's standard as follows:

1. Abachi Wood.
2. Nominal Louver Width: 2 inch.

B. Tilt Operation: Manual with wand.

C. Cord-Lock Operation: Top-locking cord lock; locks pull cord to stop blind in either fully opened or fully closed position only and is equipped with a ring pull not more than 10 inches (250 mm) long.

1. Position of Cord Lock: Right side, unless otherwise indicated.

D. Cord Equalizers: Self-aligning to maintain horizontal louver blind position.

E. Valance: Match color of louvers.

F. Mounting: End.

G. Mounting: As indicated.

H. Colors and Patterns: Where manufacturer's standard products are indicated, provide horizontal louvers complying with the following requirements:

1. Provide Architect's selections from manufacturer's full range of colors and patterns for horizontal louver blinds of type indicated.

2.3 FABRICATION

A. Product Standard and Description: Comply with AWCMA Document 1029 for each horizontal louver blind unit consisting of louvers, rails, cord locks, tilting mechanisms, tapes, and installation hardware.

B. Lifting and Tilting Mechanisms: Noncorrosive, self-lubricating materials.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Blind Units Installed Between (Inside) Jambs mounted alligned with highest horizontal million: Width equal to 1/4 inch (6 mm) per side or 1/2 inch (12 mm) total, plus or minus 1/8 inch (3 mm), less than jamb to jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch (6 mm), plus or minus 1/8 inch (3 mm), less than head to sill dimension of opening in which each blind is installed.

D. Installation Fasteners: Not less than 2 fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; support blind units under conditions of normal use.

E. Hold-Down Brackets: Manufacturer's standard, as indicated.

F. Warranty: Lifetime limited warranty.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of horizontal louver blinds. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install blinds level, plumb, and located so exterior louver edges in any position are not closer than 1 inch (25 mm) to interior face of glass lites.

1. Flush Mounted: Install blinds with louver edges flush with finish face of wall.

3.3 ADJUSTING

A. Adjust components and accessories for proper operation.

3.4 CLEANING

A. Clean blind surfaces, according to manufacturer's instructions, after installation.

B. Remove surplus materials, packaging, rubbish, and debris resulting from installation. Leave installation areas neat, clean, and ready for use.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensure that horizontal louver blinds are without damage or deterioration at the time of Substantial Completion.

3.6 BLIND SCHEDULE

A. Provide blinds for all new windows.

END OF SECTION 125110

# SECTION 142400 - MACHINE ROOM-LESS HYDRAULIC ELEVATORS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes: Hydraulic passenger elevators as shown and specified. Elevator work includes:
1. Standard pre-engineered hydraulic passenger elevators.
2. Elevator car enclosures, hoistway entrances and signal equipment.
3. Jack(s).
4. Operation and control systems.
5. Accessibility provisions for physically disabled persons.
6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
7. Materials and accessories as required to complete the elevator installation.

B. Related Sections:
1. Division 03 Concrete: Installing inserts, sleeves and anchors in concrete.
2. Division 04 Masonry: Installing inserts, sleeves and anchors in masonry.
3. Division 05 Metals:
   a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
   b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.
4. Division 09 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
5. Division 22 Plumbing:
   a. Sump pit and oil interceptor.
6. Division 23: Heating and Ventilation:
   a. Heating and ventilating hoistways.
7. Division 26 Sections:
   a. Providing electrical service to elevators. (note: fused disconnect switch to be provided as part of elevator manufacture product, see section 2.11 Miscellaneous elevator components for further details.)
   b. Emergency power supply, transfer switch and auxiliary contacts.
   c. Heat and smoke sensing devices.
   d. Convenience outlets and illumination in hoistway and pit.

C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Section 300 for hydraulic elevators. State or local requirements must be used if more stringent.

1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
3. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2'' at any point.
4. Elevator hoistways shall have barricades, as required.
5. Install bevel guards at 75° on all recesses, projections or setbacks over 2'' (4'' for A17.1 2000

areas) except for loading or unloading.

6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. All wire and conduit should run remote from the hoistways.
10. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
11. Install and furnish finished flooring in elevator cab.
12. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
13. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
14. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
15. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
16. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
17. General Contractor shall fill and grout around entrances, as required.
18. All walls and sill supports must be plumb where openings occur.
19. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
20. Provide telephone line, light fixture (200 lx / 19 fc), and convenience outlet in the hoistway at the landing where the elevator controller is located. Typically this will be at the landing above the 1st floor. Final location must be coordinated with elevator contractor.
21. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway.
22. For signal systems and power operated door: provide ground and branch wiring circuits.
23. For car light and fan: provide a feeder and branch wiring circuits to elevator control cabinet.
24. Controller landing wall thickness must be a minimum of 8 inches thick. This is due to the controller being mounted on the second floor landing in the door frame on the return side of the door. For center opening doors, the controller is located on the right hand frame (from inside the elevator cab looking out). These requirements must be coordinated between the general contractor and the elevator contractor.
25. Cutting, patching and recesses to accommodate hall button boxes, signal fixtures, etc..

## 1.3 SUBMITTALS

A. Product data: When requested, the elevator contractor will provide standard cab, entrance and signal fixture data to describe product for approval.

B. Shop drawings:
   1. Show equipment arrangement in the pit and hoistway. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
   2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.

3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
4. Indicate electrical power requirements and branch circuit protection device recommendations.

C. Powder Coat Paint selection: Submit sample selected; Refer to the Material / Finish Key on Drawings.

D. Plastic laminate selection: Submit sample selected; Refer to the Material / Finish Key on Drawings.

E. Metal Finishes: Submit sample selected; Refer to the Material / Finish Key on Drawings.

F. Operation and maintenance data. Include the following:
1. Owner's Manual and Wiring Diagrams.
2. Parts list, with recommended parts inventory.

## 1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: An approved manufacturer with minimum fifteen years experience in manufacturing, installing, and servicing commercial elevators.
1. Must be the manufacturer of the power unit, controller, signal fixtures, door operators cab, entrances, and all other major parts of the elevator operating equipment.
a. The major parts of the elevator equipment shall be manufactured in the United States, and not be an assembled system.
2. The manufacturer shall have a documented, on-going quality assurance program.
3. ISO-9001:2000 Manufacturer Certified
4. ISO-14001:2004 Environmental Management System Certified

B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than fifteen years of satisfactory experience installing elevators equal in character and performance to the project elevators.

C. Regulatory Requirements:
1. ASME/ANSI A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
2. Building Code: National.
3. NFPA 70 National Electrical Code.
4. NFPA 80 Fire Doors and Windows.
5. Americans with Disabilities Act Accessibility Guidelines (ADAAG).
6. CAN/CSA C22.1 Canadian Electrical Code.
7. CAN/CSA B44 Safety Code for Elevators and Escalators.

D. Fire-rated Entrance Assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(B), and NFPA 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).

E. Inspection and testing: Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
1. Arrange for inspections and make required tests.
2. Deliver to the Owner upon completion and acceptance of elevator work.

## 1.5 DELIVERY, STORAGE AND HANDLING

A. Manufacturing will deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.6 PROJECT CONDITIONS

A. Prohibited Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

1.7 WARRANTY

A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after completion of installation or acceptance thereof by beneficial use, whichever is earlier.

1.8 MAINTENANCE

A. Furnish maintenance and call back service for a period of 24 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours, excluding callbacks. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation.

1. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: ThyssenKrupp Elevator

2.2 MATERIALS, GENERAL

A. Colors, patterns, and finishes: Refer to the Material / Finish Key on Drawings.

B. Steel:
1. Shapes and bars: Carbon.
2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
3. Finish: Factory-applied baked enamel for structural parts, powder coat for architectural parts. Color selection must be based on elevator manufacture’s standard selections.

C. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness; Refer to the Material / Finish Key on Drawings.

D. Flooring by others; Refer to the Material / Finish Key on Drawings.

2.3 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood subfloor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

B. Sling: Steel stiles affixed to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.

D. Guide Shoes: Slide guides shall be mounted on top and bottom of the car.

E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on a steel template that is fastened to the pit floor. Provide extensions if required by project conditions.

F. Jack: Jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to insure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless telescopic 2-stage. Two jacks piped together, mounted one on each side of the car with each having two telescopic sections designed to extend in a synchronized manner when oil is pumped into the Assembly. Each jack section will be guided from within the casing or the plunger assembly used to house the section. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section.

G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the landings and correct for overtravel or undertravel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. Provide proper grade readily biodegradable oil as specified by the manufacturer of the power unit (see Power Unit section 2.04.G for further details).

I. Pit moisture/water sensor located approximately 1 foot above the pit floor to be provided. Once activated, elevator will perform “flooded pit operation”, which will run the car up to the designated floor, cycle the doors and shut down and trip the circuit breaker shunt to remove 3 phase power from all equipment, including pit equipment.

J. Motorized oil line shut-off valve shall be provided that can be remotely operated from the controller landing service panel. Also a means for manual operation at the valve in the pit is required.

K. Pit Access: A vertical ladder of non-combustible material extending 42” minimum, (48” minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.

## 2.4 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit located in the elevator pit consisting of the following items:
   1. NEMA 4/Sealed Oil reservoir with tank cover including vapor removing tank breather
   2. An oil hydraulic pump.
   3. An electric motor.
   4. Electronic oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.

B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating – motors shall be capable of 80 starts per hour with a 30% motor run time during each start.

D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.

L. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.

M. A secondary hydraulic power source (powered by 110VAC single phase) must be provided. This is required to be able to raise (reposition) the elevator in the event of a system component failure (i.e. pump motor, starter, etc.)

N. Oil Type: Readily biodegradable that is USDA certified biobased product, ultra low toxicity, readily biodegradable, energy efficient, high performing fluid made from canola oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives. Especially formulated for operating in environmentally sensitive areas. USDA certified biobased product, 95% bio-based content, per ASTM D6866.

## 2.5 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.
1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates, sight guards, and necessary hardware.
2. Main landing door & frame finish: Stainless steel panels, no. 4 brushed finish.
3. Typical door & frame finish: Stainless steel panels with no. 4 brushed finish.

B. Integrated Control System: the elevator controller to be mounted to hoistway entrance above 1st landing. The entrance at this level, shall be designed to accommodate the control system and provide a means of access to critical electrical components and troubleshooting features. See section 2.9 Control System for additional requirements.

C. At the controller landing, the hoistway entrance frame shall have space to accommodate and provide a lockable means of access (group 2 security) to a 3 phase circuit breaker. See section 2.11 Miscellaneous Elevator Components for further details.

D. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code.

Provide door restriction devices as required by code.

E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

## 2.6 CAR ENCLOSURE

A. Car Enclosure:
1. Walls: Cab type TKAP with brushed stainless steel reveals, reinforced cold-rolled steel with two coats factory applied baked enamel finish with laminate clad wall panels.
2. Canopy: Cold-rolled steel with hinged exit.
3. Ceiling: Downlight type, metal pans with suspended LED downlights with brushed stainless steel finish.
4. Cab Fronts, Return,Transom, Soffit and Strike: Provide panels faced with brushed stainless steel.
5. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
   a. Door Finish: Stainless steel panels: No. 4 brushed finish.
   b. Cab Sills: Extruded aluminum, mill finish.
6. Handrail: Provide 1.5'' diameter cylindrical metal on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, no. 4 brushed finish.
7. Ventilation: Manufacturer’s standard exhaust fan, mounted on the car top.

B. Car Top Inspection: Provide a car top inspection station with an “Auto-Inspection” switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station will give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

## 2.7 DOOR OPERATION

A. Door Operation: Provide a direct current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. Door movements shall be electrically cushioned at both limits of travel and the door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. Closed-loop, microprocessor controlled motor-driven linear door operator, with adjustable torque limits, also acceptable. AC controlled units with oil checks or other deviations are not acceptable.

1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel will reverse and the door will reopen to answer the other call.

4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer will sound. When the obstruction is removed, the door will begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors will stop and resume closing only after the obstruction has been removed.
5. Limited Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors will reverse and reopen partially. After the obstruction is cleared, the doors will begin to close.
6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors will recycle closed then attempt to open six times to try and correct the fault.
7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors will recycle open then attempt to close six times to try and correct the fault.
8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Devices: Provide a door protection system using 150 or more microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

## 2.8 CAR OPERATING STATION

A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Swing return shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED’s shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.

B. Emergency Communications System: Integral phone system provided.

C. Auxiliary Operating Panel: Not Required

D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.

E. Special Equipment: Not Applicable

## 2.9 CONTROL SYSTEMS

A. Controller: Shall be integrated in a hoistway entrance jamb. Should be microprocessor based, software oriented and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

B. Service Panel – to be located outside the hoistway in the controller entrance jamb and shall provide the following functionality/features:
1. Access to main control board and CPU
2. Main controller diagnostics
3. Main controller fuses
4. Universal Interface Tool (UIT)

5. Remote valve adjustment
6. Electronic motor starter adjustment and diagnostics
7. Operation of pit motorized shut-off valve with LED feedback to the state of the valve in the pit
8. Operation of auxiliary pump/motor (secondary hydraulic power source)
9. Operation of electrical assisted manual lowering
10. Provide male plug to supply 110VAC into the controller
11. Run/Stop button

C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

D. Special Operation: Not Applicable

E. Emergency Power Operation: (Battery Lowering 10-DOC) When the loss of normal power is detected, a battery lowering feature is to be activated. The elevator will lower to a predetermined level and open the doors. After passengers have exited the car, the doors will close and the car will shutdown. When normal power becomes available, the elevator will automatically resume operation. The battery lowering feature is included in the elevator contract and does not utilize a building-supplied standby power source.

## 2.10 HALL STATIONS

A. Hall Stations, General: Provide buttons with red-illuminating LED halos to indicate that a call has been registered at that floor for the indicated direction. Provide 1 set of pushbutton risers.
Provide one pushbutton riser with faceplates having a brushed stainless steel finish.
1. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.

B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

## 2.11 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.

B. Lockable three phase circuit breaker with auxiliary contact with shunt trip capability to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb and should be sized according to the National Electrical Code.

C. Lockable single phase 110V circuit breaker for cab light and fan to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb should be sized according to the National Electrical Code.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and control space, as constructed and verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

## 3.2 INSTALLATION

A. Install elevator systems components and coordinate installation of hoistway wall construction.
   1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
   2. Comply with the National Electrical Code for electrical work required during installation.

C. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.

D. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.

E. Lubricate operating parts of system where recommended by manufacturer.

## 3.3 FIELD QUALITY CONTROL

A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required by A17.1 Code and local authorities having jurisdiction. Perform other tests, if any, as required by governing regulations or agencies.

B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

## 3.4 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

## 3.5 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless stall shall be cleaned with soap and water and dried with a non-abrasive surface; shall not be cleaned with bleached-based cleansers.

B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.

## 3.6 PROTECTION

A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

## 3.7 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

## 3.8 ELEVATOR SCHEDULE

A. Elevator Qty. 1
1. Elevator Model: enduraMRL Above-Ground (1-Stage)
2. Rated Capacity: 2100 lbs.
3. Rated Speed: 125 ft./min.
4. Operation System: TAC32
5. Travel: 14'-0"
6. Landings: 2 total
7. Openings:
   a. Front: 2
8. Clear Car Inside: 5' - 8" wide x 4' - 3" deep
9. Cab Height: 8'-0" nominal
10. Hoistway Entrance Size: 3' – 0" wide x 7'-0" high
11. Door Type: Single Speed
12. Power Characteristics: 460 volts, 3 Phase, 60 Hz.
13. Seismic Requirements: Zone 1
14. Fixture & Button Style: Signa 4
15. Special Operations: None

END OF SECTION 142400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# SECTION 144250 - VERTICAL WHEELCHAIR LIFTS

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SECTION INCLUDES

A. Enclosed Vertical Wheelchair Lift.

### 1.3 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Blocking in framed construction for lift attachment.

B. Division 16 - Electrical: Lighting and wiring connections at top of shaft.

C. Division 16 - Electrical: Electrical power service and wiring connections.

### 1.4 REFERENCES

A. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.

B. CSA B44 - Safety Code for Elevators and Escalators.

C. CSA B355 - Lifts for Persons with Physical Disabilities.

D. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.

E. NFPA 70 - National Electric Code.

F. CSA - National Electric Code.

### 1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Submit manufacturer's installation instructions, including preparation, storage and handling requirements.
2. Include complete description of performance and operating characteristics.
3. Show maximum and average power demands.

C. Shop Drawings:
1. Show typical details of assembly, erection and anchorage.
2. Include wiring diagrams for power, control, and signal systems.
3. Show complete layout and location of equipment, including required clearances and coordination with shaft way.

D. Selection Samples: For each finished product specified, provide one complete set of color chips representing manufacturer's full range of available colors and patterns.

### 1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm with minimum 10 years experience in manufacturing of vertical platform lifts, with evidence of experience with similar installations of type specified.

B. Installer Qualifications: Licensed to install equipment of this scope, with evidence of experience with specified equipment. Installer shall maintain an adequate stock of replacement parts, have qualified people available to ensure fulfillment of maintenance and callback service without unreasonable loss of time in reaching project site.

1.7 REGULATORY REQUIREMENTS

A. Provide platform lifts in compliance with:
1. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
2. NFPA 70 - National Electric Code.

B. Provide platform lifts in compliance with:
1. CSA B355 - Lifts for Persons with Physical Disabilities.
2. CSA - National Electric Code.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store components off the ground in a dry covered area, protected from adverse weather conditions.

1.9 PROJECT CONDITIONS

A. Do not use wheelchair lift for hoisting materials or personnel during construction period.

1.10 WARRANTY

A. Warranty: Provide a two year limited warranty for wheelchair lift materials and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Garaventa Lift; United States - P.O. Box 1769, Blaine, WA 98231-1769. Local dealer contact is Richard Davis, Lift Aids, Inc. Euless, Texas Phone:800-351-5438. Fax: 817-835-0096 Email:rdavis@lift-aids.com. Web:www.garaventalift.com.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 ENCLOSED VERTICAL WHEELCHAIR LIFT

A. Capacity: 750 lbs (340 kg) rated capacity.

B. Mast Height:
1. Model GVL-EN-168; 171 inches (4343 mm) maximum lifting height, using hydraulic drive, only.

C. Nominal Clear Platform Dimensions:
1. Large: 45 ½” inches (1155 mm) by 56-7/8” inches (1446 mm).

D. Platform Configuration:
1. 90 Degree Entry/Exit: Front and side openings.

E. Landing Openings:
   1. Lower Landing: Door.
   2. Upper Landing: Gate.

F. Doors and Gates: Doors and gates shall be self closing type.
   1. Door Height: Flush mount, 80 inches (2032 mm).
   2. Gate Height: Flush mount, 42-1/8 inches (1070 mm).
   3. Door Construction: Aluminum frame with:
      a. Panels of 16 gauge (1.5 mm) painted galvanized steel.
   4. Power Door/Gate Operator: Automatically opens the door/gate when platform arrives at a landing. Will also open at landing by pressing call button or gently the pulling door.
      a. Location:
         1) Lower Landing: Door.
         2) Upper landing: Door or Gate.

G. Lift Components:
   1. Machine Tower: Custom aluminum extrusion.
   2. Base Frame: Structural steel.
   3. Platform Side Wall Panels: 42-1/8 (1070 mm) inches high. 16 gauge (1.5 mm) galvanized steel sheet. Custom aluminum extrusion tubing frame.
   4. Enclosure Panels:
      a. 16 gauge (1.5 mm) painted galvanized steel sheet.

H. Enclosure Height Above Upper landing:
   1. Enclosure shall extend 42-1/8 inches (1070 mm) above the upper landing level

I. Base Mounting and Access to Lift at Lower Landing:
   1. Pit Mount: Lift to be mounted in pit with dimensions to meet manufacturer's requirements for the platform size specified. Pit construction shall be in accordance to Section 03300.

J. Hydraulic Drive:
   1. Drive Type: Chain hydraulic.
   2. Emergency Operation: Manual device to lower platform and use auxiliary battery power to raise or lower platform.
   3. Safety Devices:
      a. Slack chain safety device.
      b. Shoring device.
   4. Travel Speed: 17 fpm (5.2 m/minute).
   5. Motor: 3.0 hp (2.2 kW); 24 volts DC.
   6. Power Supply:
      a. 120 VAC single phase; 60 Hz on a dedicated 15 amp circuit.
      b. Powered by building continuous mains converted to 24 VDC and equipped with auxiliary battery backup power system capable of running lift up and down for a minimum of 5 trips with rated load. Required for high use lifts and lifts equipped with a fan and ventilation system.

K. Platform Controls: 24 VDC control circuit with the following features.
   1. Direction Control: Constant pressure rocker switch.
   2. Illuminated and audible emergency stop switch shuts off power to lift and activates audio alarm equipped with battery backup.
   3. Keyed operation.
   4. Arrival Gong and Digital Floor Display.

L. Call Station Controls: 24 VDC control circuit with the following features.
   1. Direction Control: Constant pressure rocker switch.

2. Keyed operation.
3. Call Station Mounting:
   a. Lower:
      1) Wall mounted surface.
   b. Upper:
      1) Wall mounted surface.

M. Safety Devices and Features:
1. Grounded electrical system with upper, lower, and final limit switches.
2. Tamper resistant interlock to electrically monitor that the door is in the closed position and the lock is engaged before lift can move from landing.

N. Finishes
1. Aluminum Extrusions: Champagne anodized finish.
2. Ferrous Components: Electrostatically applied baked powder finish, fine textured.
   a. Color: Satin Grey, RAL 7030.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify shaft and machine space are of correct size and within tolerances.

C. Verify required landings and openings are of correct size and within tolerances.

D. Verify electrical rough-in is at correct location.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install lifts in accordance with applicable regulatory requirements including ASME A17.1, ASME A18.1 and the manufacturer's instructions.

B. Install lifts in accordance with applicable regulatory requirements including CSA B355, and manufacturer's instructions.

C. Install system components and connect to building utilities.

D. Accommodate equipment in space indicated.

E. Startup equipment in accordance with manufacturer's instructions.

F. Adjust for smooth operation.

3.4 FIELD QUALITY CONTROL

A. Perform tests in compliance with ASME A17.1 or A18.1 and as required by authorities having jurisdiction.

B. Perform tests in compliance with CSA B355 and required by authorities having jurisdiction.

C. Schedule tests with agencies and Architect, Owner, and Contractor present.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 144250


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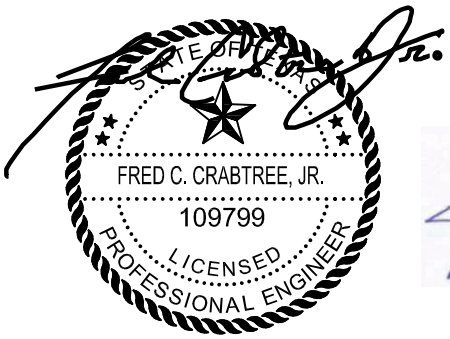


**2017-06-16**
**DIVISION 21, 22, & 23**


**2017-06-16**
**DIVISION 27 & 28**

SECTION 21 00 10 - GENERAL REQUIREMENTS FOR FIRE SUPPRESSION WORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General Requirements for Fire Suppression Work are intended to be complementary to the General Requirements of the Construction Contract.

B. Work Included: Design and install a complete fire suppression systems where shown on the drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to the following summary of work:

1. Design and install a wet-pipe fire suppression system for the entire building and dormitory units.

a. Piping 4 inches and larger shall be schedule 40 steel. Piping 3 inches and smaller shall be FM approved CPVC.

2. All sprinklers shall be concealed type including sidewall sprinklers.

a. Provide extended coverage concealed sidewall sprinklers in the dormitory units, lounges, study rooms, etc. as required to minimize branch piping.

3. Provide dry sprinklers for exterior covered breezeways, patios, and other ancillary spaces that are not heated.

4. Provide wet standpipes with Fire Marshal approved hose connections in the stairwells and connect to Fire Department Connections as shown on the plans and located per the Fire Marshal.

1.2 QUALITY ASSURANCE AND APPLICABLE STANDARDS

A. Use adequate numbers of skilled workers that are thoroughly trained and experienced in the necessary crafts and are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Architect/Engineer/Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. Codes: Perform all work in accordance with the latest edition of the following codes:

1. State and city building, fire, plumbing, and mechanical codes.

2. National Electrical Code (NEC)

3. National Fire Protection Association (NFPA)

4. American with Disabilities Act (ADA)

5. Texas Accessibility Standards (TAS)

6. National Fire Protection Association (NFPA)

7. All authorities having jurisdiction.

D. Where conflicts occur between drawings, specifications, and code requirements, the most stringent requirement shall take precedence.

E. Standards: The specifications and standards of the following organizations are by reference made a part of these specifications. All work, unless otherwise indicated, shall comply with the requirements and recommendations wherever applicable:

1. American National Standards Institute (ANSI)

2. American Society for Testing and Materials (ASTM)

3. American Society of Mechanical Engineers (ASME)

4. Electrical Testing Laboratories (ETL)

5. National Bureau of Standards (NBS)

6. National Electrical Manufacturer's Association (NEMA)

7. Underwriters Laboratories, Inc. (UL)

F. Electrical Characteristics for Equipment: Equipment of differing electrical characteristics may be furnished provided such equipment is proposed on the “Alternate Manufacturer Evaluation Form”, subsequently approved, and connecting electrical services, circuit breakers, and conduit sizes appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

G. When requested, provide the Owner’s Authorized Representative with manufacturer’s certificate that materials meet or exceed minimum requirements as specified.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. The requirements and recommendations of the latest edition of the Occupational Safety and Health Administration (OSHA) Act are by reference made a part of these specifications. All work shall comply with the requirements and recommendations wherever applicable.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. All Other Sections of Divisions 21, 22, 23 and 26 (as applicable).

B. All other divisions of the contract documents. Refer to each division's specifications and drawings for all requirements

1.5 SUBMITTALS

A. Comply with pertinent provisions of Division 01.

B. Provide Specifications per Division 01 for all submitted alternate equipment.

Product Data: Submit the following:

1. Materials list of items proposed to be provided under Division 21.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in the following paragraph.

3. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Architect/Engineer/Owner can easily determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Organize in a clear and concise format. All substitutions shall be approved in writing by Architect/Engineer. The Architect/Engineer's decision shall be final.

4. Allow a minimum of ten (10) working days for the review of submittals and each re-submittal.

5. Compliance with the Contract documents shall be the sole responsibility of the Contractor. Items on equipment that are were not accepted by the Architect/Engineer in writing as an approved equal shall be replaced or revised to comply with the contract documents at the Contractor's expense.

6. Manufacturer's recommended installation procedures which, when reviewed by the Architect/Engineer, shall become the basis for accepting or rejecting actual installation procedures used on the work.

7. Sign the submittal as an indication of compliance with the contract documents. Any deviations from the contract documents shall be indicated on the submittal prior to signing. Any deviations not indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor's expense.

C. Submittals required of materials and equipment under this section shall include the following:

1. Piping and Accessories Materials

a. Clearly marked up manufacturer's data showing compliance with the specifications for:

1) Piping material proposed for each system.

2) Valves, cocks, and specialties.

4) Fire suppression specialties.

5) Flexible connectors for piping.

6) Flanges.

b. l/8" scale (minimum) fire suppression piping shop drawings showing coordinated piping routing and arrangements with all equipment, and accessories.

2. Vibration Isolation and Sound Control Materials

a. Submit shop drawings showing the structural design and details of

custom-fabricated work not covered by manufacturer's submitted data.

3. Identification Materials

a. Clearly marked-up product literature or samples showing compliance with specified materials for:

1) Valve tagging.

2) Pipe marking.

3) Equipment marking.

4. Fire Protection System

a. Provide hydraulic calculations.

b. Provide clearly marked-up manufacturer's data showing compliance with the specifications for:

1) All required system piping, valves and switches.

2) Sprinkler heads for all areas and sprinkler cabinet.

3) Fire department connections.

d. Submit all hydraulic calculations and drawings to be submitted to the Authority Having Jurisdiction and obtain stamp of approval prior to submission to the Architect/Engineer.

5. Heat Trace Cabling

a. Clearly marked-up product literature or samples showing compliance with specified materials for:

1) Electrical characteristics.

2) Installation methods.

6. Record Documents: Reference the requirements detailed in this section.

7. Operation and Maintenance Data: Reference the requirements detailed in this section.

D Resubmittals of rejected submittals shall be limited to one (1) in number. Costs for processing subsequent resubmittals in excess of the first resubmittal, resulting from the Contractor's disregard of Architect/Engineer's primary submittal rejection comments, shall be borne by the Contractor. Costs shall be based on Architect/Engineer's hourly rates as published in their current professional fee schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost plus fifteen percent (15%).

E. Shop Drawings: Upon written request of the Contractor, the Architect/Engineer will provide directly to the Contractor electronic backgrounds of drawings required to produce shop drawings. The requirements to secure electronic files for shop drawing purposes are the same as for record drawing purposes. See 210010, Paragraph 1.15.H.2.

1.6 SUBSTITUTIONS

A. The use of manufacturers' names and catalog numbers followed by the phrase "or equal" is generally used to establish a standard of quality and utility for the specified items and to provide a dimensional reference for construction documents that are drawn to scale.

B. Submittals for "equal" items shall, where applicable, include the following data that are not necessarily required for specified items:

1. Performance characteristics.

2. Materials.

3. Finish.

4. Certification of conformance with specified codes and standards.

5. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in Paragraph 6 below.

6. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Architect/ Engineer/Owner can easily determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Include shop drawings for all piping and fire suppression equipment per Paragraph 1.5 Submittals. Organize in a clear and concise format.

C. Submittals of "equal" components or systems may be rejected if:

1. The material or equipment would necessitate the alteration of any portion of the fire protection, architectural or structural design.

2. Dimensions vary from the specified material or equipment in such a manner that accessibility or clearances are impaired or the work of other trades is adversely affected.

D. Proposed substitutions for materials or equipment must be submitted ten (10) days prior to final bid date for consideration as approved equals. Otherwise, such substitutions will not be permitted. Only Prime Bidders are allowed to make proposals for substitutions. Manufacturers, distributors, and sub-contractors shall not make proposals to the Architect/Engineer for substitutions.

E. No substitution shall be made unless authorized in writing by the Architect/Engineer. Should a substitution be accepted, and should the substitute material prove defective or otherwise unsatisfactory for the service intended, and within the guarantee period, replace this material or equipment with material or equipment specified, at no additional cost to the Architect/Engineer/Owner, and to the satisfaction of the Architect/Engineer.

F. Contractors submitting bids on substitute materials and equipment must also provide a written performance guarantee certifying that the substitute materials and equipment will produce the specified effects and meet the approval of the Architect/Engineer.

1.7 ORDINANCES, PERMITS, METERS, UTILITIES, AND ROYALTIES

A. Procure all permits and licenses necessary for completion of this project and pay all lawful fees required and necessary pursuant in obtaining said permits and licenses. All required certificates of approvals and inspections by local governing and regulating authorities shall be obtained and paid for by the Contractor.

B. Pay all fees required for the connection of water service to utility mains, and any meter fees if required.

C. Pay any royalty payments required or fees for the use of patented equipment or systems. Defend all law suits or claims for infringement of any patent rights and shall hold the Owner and Architect/Engineer harmless from loss as a result of said suits or claims.

1.8 COMPATIBILITY OF EQUIPMENT

A. Assume full responsibility for satisfactory operation of all component parts of the fire suppression systems to assure compatibility of all equipment and performance of the integrated systems in accordance with the requirements of the specifications. Should the Contractor consider any part of the specifications or drawings as rendering his acceptance of such responsibility impossible, prohibitive, or restrictive, he shall notify the Architect/Engineer before submitting his bid, and the bid shall be accompanied by a written statement of any objections or exceptions to the specifications and drawings.

1.9 EXISTING UTILITIES AND TEMPORARY SERVICES FOR CONSTRUCTION

A. Verify the location and capacity of existing utility services pertaining to work of Division 21. Relocate existing utilities unearthed by excavation as directed by the utility service companies affected.

B. Temporary Services for Construction

1. Provide temporary services in strict accordance with the provisions of these specifications.

1.10 EXCAVATION AND BACKFILLING

A. Perform all excavation and backfilling necessary for the installation of the work. This shall include shoring and pumping in ditches to keep them in dry condition until the work has been installed. Properly perform all shoring required to protect the excavation and to safeguard employees.

B. Perform excavation and backfilling in strict accordance with the provisions of these specifications including trench safety requirements.

C. Make all excavations to the proper depth, with allowances made for floor slabs, forms, beams, etc. Properly compact ground under piping before installing piping.

D. Provide backfilling with selected soil, free from rocks and debris and pneumatically tamp with 6-inch layers to secure a field density ratio of 95 percent as defined by ASTM Designation D698-57T (Proctor Soil Compaction Test).

E. Remove from the site, excavated materials not suitable and not used in the backfill.

F. Field check and verify the locations of all underground utilities. Avoid disturbing these as far as possible. In the event existing utilities are damaged, repair them at no cost to the Architect/Engineer/Owner.

G. In a lime-stabilized area, fully restore the lime stabilization after the excavation is complete.

H. Replace concrete, curbs, paving, and other surface improvements cut during excavation to their original condition.

1.11 JOBSITE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Include required work to correct conditions detrimental to the timely and proper completion of all Division 21 Work. Do not proceed until unsatisfactory conditions are corrected.

1.12 PREPARATION AND COORDINATION

A. Perform coordination work in strict accordance with provisions of these specifications and the following:

1. Coordinate as necessary with other trades to assure proper and adequate interface with all work.

2. Where pipes and other fire suppression items are shown in conflict with locations of structural members and other equipment, include labor and materials required for extensions, offsets and supports to clear the encroachment.

3. Although such work is not specifically indicated, provide all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation.

4. Coordinate accepted equipment changes from those scheduled or specified with other trades affected. Additional compensation to other trades for equipment changes is the responsibility of the Contractor making the change.

B. Fire Suppression Drawings are diagrammatic. Follow the drawings as closely as actual construction and work of other trades will permit. Piping arrangements shall be designed for maximum economy consistent with good practice and other considerations. Install the systems arranged as shown on the drawings, except as otherwise approved in advance by the Architect/Engineer.

C. Data indicated on the Drawings and in these Specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels, and other conditions will be governed by actual construction and the Drawings and Specifications should be used only for guidance in such regard.

D. Where items are not specifically located on the Drawings, provide an RFI to the Architect/Engineer, and locate as determined in the field by the Architect/Engineer. Where such items are installed without such specific direction, relocate as directed by the Architect/Engineer, and at no additional cost to the Architect/Engineer/Owner.

E. Verify all dimensions and distances. No additional compensation will be allowed because of differences between work shown on the Drawings and actual dimensions and distances at the jobsite.

1.13 CONSTRUCTION REQUIREMENTS

A. The drawings show the arrangements of work. Should project conditions necessitate

rearrangement, or if the materials or equipment can be installed to a better advantage in a different manner, before proceeding with the work, prepare and submit five copies of Drawings of the proposed arrangement for the Architect/Engineer's review. Allow a minimum of ten (10) working days for review.

B. Should the Contractor propose to install equipment requiring space conditions other than those shown, or rearrange the equipment, he shall assume responsibility for the rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such changes shall be accompanied by contractor-generated detailed shop drawings of the space in question. Identify monetary credits proposed or other benefits of the change. Allow a minimum of ten (10) working days for review.

C. Properly locate and size all slots, holes, and openings in the building structure pertaining to the work and for the correct location of pipe sleeves, duct sleeves, fire dampers, etc., as applicable to the work.

1.14 CUTTING AND PATCHING

A. Perform cutting and patching associated with the work in strict accordance with the provisions of Division 1 of these Specifications and the following:

1. Coordinate work to minimize cutting and patching work.

2. Request for Architect/Engineer's Consent

a. Prior to cutting or coring of the building structure, submit a written request to the Architect/Engineer for permission to proceed with cutting. Include x-rays of any floor area where cutting or coring is proposed.

b. Contractor is cautioned that concrete floor may contain steel tendons, pipes, and electrical/telecom conduits, all of which can not be cut or damaged.

3. Perform Architect/Engineer-approved cutting and demolition by methods that will prevent damage to other portions of the work and provide proper surfaces to receive installation of new work and repair.

4. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.

5. Provide all core drilling of holes. Where sleeves and blockouts are required, they shall be cut or provided at locations required. On completion of this work or as work progresses, make all repairs and do all patching required as a result of work under this Contract. All patching shall be performed in a manner that will restore the surrounding work to its original condition to the satisfaction of the Architect/Engineer.

6. Assume responsibility for the proper size of all sleeves and blockouts in the building structure pertaining to the work and for providing the correct location of pipe sleeves and blockouts.

7. Where openings are cut through masonry walls, provide lintels or structural supports to protect the remaining masonry. Provide adequate support during the cutting operation to prevent any damage to the affected masonry.

1.15 PROJECT RECORD DOCUMENTS

A. Provide the record documents associated with the work of Division 21 in strict accordance with the provisions of these specifications.

B. Throughout progress of the Division 21 Work, maintain an accurate record of changes in the Contract Documents that apply to work of Division 21. Changes shall include all addendums issued during bidding. Maintain an accurate record of the location of fire suppression service lines and outlets and all outside utilities.

C. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Architect/Engineer. Submit in writing at the pre-construction conference the name and credentials of the person responsible for record mark-ups and maintenance.

D. Accuracy of Records

1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of drawings and other documents where such entry is required to show the change properly. Match the symbology and format of the base documents.

2. Accuracy of records shall be such that a future verification of items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

E. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of all recorded data to the final Project Record Documents.

F. Making Entries on Drawings

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.

2. Date all entries.

3. Call attention to the entry by a "cloud" drawn around the area or areas affected.

4. In the event of overlapping changes, use different colors for the overlapping changes.

5. Make entries within 24 hours after receipt of information that the change has occurred.

6. Maintain the base drawing format and use the same symbology.

7. Convert field mark-ups to finished CADD record drawings when required in this section.

G. Conversion of Schematic Layouts

1. In some cases on the drawings, arrangements of equipment, piping, and similar items are shown schematically and are not intended to portray precise physical layout. Determine final physical arrangement subject to the Architect/Engineer's approval. However, design of future modifications of the facility may require accurate information as to the final physical layout of items that are shown only schematically on the drawings.

2. Show on the job set of record drawings, by dimension accurate to within one inch, the centerline of each run of items such as all sleeves and piping, etc., below grade, in walls,

or in the concrete slab. A surface mounted device indicates the exact location:

a. Clearly identify the item by accurate note such as "Fire Suppression Piping" and the like.

b. Show, by symbol or note, the vertical location of the item "under slab," "in ceiling plenum," "exposed," and the like.

c. Make all identification sufficiently descriptive that it may be related reliably to the specifications.

H. Final Project Record Documents

1. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.

2. Provide CADD electronic files in ".dwg" Format using AutoCAD Release 2012 software (minimum). Upon written request and completion of a release form, the Engineer will provide AutoCAD Release 2012 electronic files of base Contract Drawings in dwg format. The Engineer will also provide a list of drawing layers and names that shall be maintained.

3. Provide completed record drawings on CD and one reproducible full-size sheet of each drawing.

4. Refer to Section 017700 for additional requirements.

1.16 OPERATION AND MAINTENANCE DATA

A. Well before substantial completion, submit two copies of a preliminary draft of the proposed manual(s) to the Architect/Engineer for review and comments. Allow a minimum of ten (10) working days for review.

B. Submit specified number copies of the approved manual to the Architect/Engineer prior to indoctrination of operation and maintenance personnel.

C. Prepare in accordance with the following standards:

Format:

Size: 8½" x 11"

Paper: White bond, at least 20 lb. weight

Text: Neatly written or printed

Drawings: 11" in height preferable; bind in with text; foldouts acceptable; larger drawings are acceptable but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.

Flysheets: Separate each section of the Manual with neatly prepared flysheets briefly describing contents of the ensuing section; flysheets may be in color.

Binding: Use heavy-duty plastic or fiberboard covers with binding mechanism concealed inside the manual; 3-ring binders will be acceptable; all binding is subject to the Architect/ Engineer's approval.

Measurements: Provide all measurements in U.S. standard units such as feet-and-inches, lbs, and cfm. Where items may be expected to be measured within ten years in accordance with metric formulae, provide additional measurements in the "International System of Units" (SI).

D. Provide front and back covers for each manual, using durable material approved by the Architect/Engineer, and clearly identified on or through the cover with at least the following information:

1. OPERATING AND MAINTENANCE INSTRUCTIONS

a. Name and Address of Work

b. Name of Contractor

c. General subject of this manual

d. Space for approval signature of the Architect/Engineer and approval date

E. Contents: Include at least the following:

1. Neatly typewritten index near the front of the manual, giving immediate information as to location within the manual of all emergency information regarding the installation.

2. Complete instructions regarding operation and maintenance of all equipment provided including lubrication, disassembly, and reassembly.

3. Complete nomenclature of all parts of all equipment.

4. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.

5. Copy of all guarantees and warranties issued.

6. Manufacturer's bulletins, drawings, and descriptive data, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.

7. Such other data as required in other sections of these specifications.

1.17 EQUIPMENT FOUNDATIONS

A. Provide equipment foundations associated with the work in accordance with the provisions of these specifications.

B. Provide concrete bases for all pad or floor mounted equipment. Bases shall be four inches (4") high above finished floors or grades (unless otherwise noted) and shall protrude two inches (2") beyond all sides of equipment and shall have exposed chamfered edges. Construct bases from ready-mixed hardrock concrete, ASTM C94, reinforced with #3 rebar, ASTM A615, Grade 40, at

18" on center each way.

C. Field verify exact location of outdoor pad mounted equipment with the Architect/ Engineer. Supply necessary fill and grade site to provide natural drainage away from equipment.

1.18 PAINTING

A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be damaged in transit or during the installation, it shall be finished to match appearance of original finish. All work shall be subject to approval by Architect/Engineer.

1.19 TESTING AND INSPECTION

A. Provide personnel and equipment, make required tests, and secure required approvals from the Architect/Engineer and governmental agencies having jurisdiction.

B. Make written notice to the Architect/Engineer, adequately in advance, of each of the following stages of construction:

1. When all rough-in is complete, but not covered;

2. As specified in all Division 21 sections.

3. At the completion of the work of Division 21.

C. When material or workmanship is found to not comply with the specified requirements, remove the noncomplying items from the job site and replace them with items complying with the specified requirements at no additional cost to the Architect/Engineer/Owner. This shall be performed within 3 days after receipt of written notice of noncompliance.

1.20 WARRANTY

A. Warranty all equipment and workmanship for a period of one year after date of substantial completion and replace or repair any faulty equipment or installation at no cost to the Architect/Engineer/Owner for such service during this period, all in accordance with requirements of Division 01.

B. This warranty shall not void specific warranties issued by manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the Owner by law.

C. Warranties shall be in writing in a form satisfactory to the Owner, and shall be delivered to the Owner before final payment is made.

1.21 PROJECT COMPLETION

A. Upon completion of the work of Division 21, thoroughly clean all exposed portions of the fire suppression installation, removing all traces of soil, labels, grease, oil, and other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned.

END OF SECTION 21 00 10

SECTION 21 01 12 – INTERDISCIPLINARY COORDINATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Refer to Section 210010 – GENERAL REQUIREMENTS FOR FIRE SUPPRESSION WORK

1.2 SUMMARY

A. This Section describes the coordination between the Mechanical, Plumbing, Fire Protection, and Electrical portions of the work.

B. This Section is also included under Divisions 21, 22, 26, and 28 portions of the Specifications.

1.3 WORK INCLUDED

A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. The schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:

| | ITEM | FURNISHED UNDER DIVISION | INSTALLED UNDER DIVISION | WIRED AND CONNECTED UNDER DIVISION |
|---|---|---|---|---|
| 1. | Equipment Motors | Note 9 | Note 9 | 26 |
| 2. | Magnetic motor Starters | | | |
| | a. Automatically controlled, with or without HOA switches. | 26 | 26 | Notes 1,3,5 |
| | b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment. | Note 9 | Note 9 | Notes 1,3,5 |
| | c. Manually controlled | 26 | 26 | Notes 1,3,5 |
| | d. Manually controlled and furnished as part of the factory wired equipment. | Note 9 | Note 9 | Notes 1,3,5 |
| | e. Furnished in motor Control Centers. | 26 | 26 | Notes 1,3,5 |
| 3. | Variable Speed (Frequency) AC Drives. | 23 | 26 | Notes 1,4,5 |
| 4. | Line voltage thermostats, time clocks, etc., not connected to control panel systems. | 23 | 23 | 26 |

| | | | | |
|---|---|---|---|---|
| 5. | Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part of directly attached to ducts, pipes, etc. | 23 | 23 | 23 |
| 6. | Temperature control panels and time switches mounted on temperature control panels. | 23 | 23 | Note 1 |
| 7. | Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc. | 23 | 23 | Note 1 |
| 8. | Alarm bells furnished with equipment installed by Division 23. | 23 | 23 | 23 |
| 9. | Wiring to obtain power for control circuits, including circuit breaker. | 26 | 26 | 26 |
| 10. | Low voltage controls | 23 | 23 | 23 |
| 11. | Fire protection system (sprinkler) controls. | 21 | 21 | Note 8 |
| 12. | Smoke detectors installed on mechanical units and in ductwork. | 26 | 23 | Note 2 |
| 13. | All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with VAC equipment to provide operation and control of HVAC equipment. | 23 | 23 | Note 1 |
| 14. | Smoke dampers, and combination fire/smoke dampers. | 23 | 23 | Note 7 |
| 15. | Boiler and water heater controls, boiler burner controls panels. | 23 | 23 | Note 1 |
| 16. | Pushbutton stations, pilot lights. | 26 | 26 | 26 |
| 17. | Heat Tape. | Note 9 | Note 9 | 26 |
| 18. | Disconnect switches, manual operating switches furnished as a part from equipment. | Note 9 | Note 9 | Notes 1, 5 |
| 19. | Disconnect switches, manual operating switches furnished separate from equipment. | 26 | 26 | 26 |
| 20. | Multispeed switches. | 23 | 23 | 26 |
| 21. | Thermal overloads. | 23 | 23 | 23 |
| 22. | Control relays, transformers. | 23 | 23 | 23 |
| 23. | Refrigeration cycle, cooling tower and controls. | 23 | 23 | 23 |
| 24. | Tamper switches for fire | 21 | 21 | 26 |

| | | | | |
|---|---|---|---|---|
| | protection (sprinkler) system. | | | |
| 25. | Flow and/or pressure switches for fire protection (sprinkler) system. | 21 | 21 | 26 |
| 26. | Fire and jockey pump controllers and automatic transfer switch. | 21 | 21 | Note 6 |
| 27. | Alarm bells or horns for fire protection system. | 21 | 21 | 26 |
| 28. | Generator (underground) fuel tank. | 22 | 22 | - |
| 29. | Generator (underground) fuel tank level indicator. | 22 | 22 | 26 |
| 30. | Generator fuel piping from tank to generator. | 22 | 22 | - |
| 31. | Underground fuel tank leak detection and monitoring system. | 22 | 22 | 22 |

Notes

(1) Power wiring as defined in Section 260519 of the specifications shall be provided under Division 26. Control wiring shall be provided under Division 23.

(2) Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 28 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 and 26 specifications and the Drawings for more specific requirements.

(3) For requirements for magnetic motor Starters, refer to Section 262913 – ENCLOSED CONTROLLERS.

(4) For requirements for Variable Speed (Frequency) AC drives, refer to Section 230514 –VARIABLE-FREQUENCY DRIVES.

(5) Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.

(6) Power wiring from energy source to controllers and automatic transfer switch shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 23 and conform to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.

(7) Division 28 will provide power to all smoke and combination fire/smoke dampers, including control wiring for all such dampers using area smoke detectors.

(8) Wiring for sprinkler system controls to be provided by Division 21. Wiring from devices to Fire Alarm System to be provided by Division 28.

(9) All components provided with packaged equipment shall be furnished and installed by the Contractor providing the equipment.

B. CONNECTIONS: Make all connections to controls that are directly attached to duct, piping, and mechanical equipment with flexible connections.

C. PRECEDENCE

1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.

2. Precedence for pipe, conduit and duct systems shall be as follows:
   a. Building lines
   b. Structural members
   c. Soil and drain piping
   d. Vent piping
   e. Steam piping
   f. Condensate piping
   g. Refrigerant piping
   h. Electrical bus duct
   i. Supply ductwork
   j. Return ductwork
   k. Exhaust ductwork
   l. Chilled water and heating water piping
   m. Automatic Fire Protection Sprinkler Piping
   n. Natural gas piping
   o. Domestic hot and cold water piping
   p. Electrical conduit

D. FINAL INSPECTION AND REPORT

1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical, Fire Alarm, and Temperature Control Contractors, representatives of mechanical and electrical equipment manufacturers whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of the meeting, listing those in attendance, and the companies that they represent shall be filed with the Owner, Architect, and Engineer of Record.

# SECTION 21 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION 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. Sleeves.
2. Sleeve-seal systems.
3. Grout.

### 1.3 ACTION SUBMITTALS

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

## PART 2 PRODUCTS

### 2.1 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

### 2.2 SLEEVE-SEAL 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. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 **EXECUTION**

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors.

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 as new slabs 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, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in slabs-on-grade at service piping entries into building.

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.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Exterior Concrete Walls Below Grade and Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

**END OF SECTION**

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# SECTION 21 05 18 - ESCUTCHEONS FOR FIRE-SUPPRESSION 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. Escutcheons.
2. Floor plates.

### 1.3 ACTION SUBMITTALS

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

## PART 2 PRODUCTS

### 2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

### 2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for 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, cast-brass type with polished, chrome-plated finish.
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, cast-brass type with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

## 3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 21 05 18

# SECTION 21 05 53 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Warning signs and labels.
2. Pipe labels.
3. Valve tags.
4. Warning tags.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

## PART 2 PRODUCTS

### 2.1 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.

C. Letter Color: White.

D. Background Color: Red.

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-fourths the size of principal lettering.

H. Fasteners: Stainless-steel rivets or 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.

## 2.2 PIPE LABELS

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. ActionCraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.
6. Craftmark.

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, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

E. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

## 2.3 VALVE TAGS

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. ActionCraft Products, Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.

6. Craftmark.
7. emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Services Inc.
11. Seton Identification Products.

B. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass wire-link chain or beaded chain.
3. Valve-Tag Color: Safety Red.
4. Letter Color: White.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) 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.

## 2.4 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark.

B. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety Yellow background with black lettering.

# PART 3 EXECUTION

## 3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

## 3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

## 3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

## 3.4 PIPE LABEL INSTALLATION

A. Piping: Painting of piping is specified in Section 099123 "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. 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 a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

## 3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:

a. Fire-Suppression Standpipe: 1-1/2 inches, round.
b. Wet-Pipe Sprinkler System: 1-1/2 inches, round.

## 3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 21 05 53

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# SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

## PART 1 - GENERAL

### 1.1 SCOPE OF STANDARD

A. This standard provides general guidance concerning the specific preferences of Midwestern State University for automatic fire sprinkler and standpipe systems.

B. The design guidelines contained herein include the requirements for systems, materials, fittings and valves utilized for fire protection systems at Midwestern State University. It is the intention of this document to provide a minimum standard for fire protection systems at Midwestern State University so as to provide the highest level of fire safety possible; it is not intended to be a guide specification.

### 1.2 SCOPE OF WORK

A. All new and renovated buildings at Midwestern State University shall have a fire sprinkler system.

B. Provide all design and materials required to provide a complete fire protection system to protect the specified building areas in accordance with design requirements. Antifreeze loops are not permitted. The preference of Midwestern State University is to provide automatic fire sprinkler systems that do not contain alarm valves, and if possible, do not require a fire pump.

C. Provide a complete automatic sprinkler system as defined by the National Fire Protection Association (NFPA) Standard 13. Wet pipe systems are the standard design at Midwestern State University Campus.

D. Required standpipe systems shall be Class I in all cases regardless of minimum code requirements.

E. The work addressed in this section consists of a fire protection system, which may include, and at least will be coordinated with all of the following:

1. Fire Alarm Systems

2. Fire, smoke, and combination fire/smoke dampers

3. Security Systems

4. Elevator installation. See the Midwestern State University Elevator Construction Standards 14 20 00 and 14 24 00.

5. Central control and monitoring system.

F. Reference Standards: NFPA 13, NFPA 14, NFPA 20, NFPA 24, NFPA 25, NFPA 72, NFPA 101. See also Section 283111, Digital Addressable Fire-Alarm System.

### 1.3 RELATED WORK: REFERENCES/QUALITY ASSURANCE

A. Industrial Risk Insurers (IRI) standards, the International Building Code, International Conference of Building Officials, and National Fire Codes as published by the National Fire Protection Agency (NFPA) with City of Wichita Falls, the State of Texas Fire Marshal’s requirements contain fire

protection criteria and requirements for the design of all fire suppression systems. The contractor shall conform to the following:

1. Conform to a minimum of NFPA 13 for sprinkler systems. IRI or Owner requirements may require design in excess of NFPA 13.

2. Conform to minimum of NFPA 14 for standpipe systems. IRI or Owner requirements may require design in excess of NFPA 14.

3. All materials and performance shall meet the appropriate ANSI, ASME and ASTM Codes.

4. All design shall conform to requirements of Industrial Risk Insurers (IRI).

5. Welding Materials and Procedures shall conform to the ASME Code.

6. Only welders certified in accordance with ANSI/ASME Section 9 shall be employed.

B. Each item of equipment shall be capable of performing its function over an extended period of time with a minimum of attention and maintenance. All equipment shall be constructed using new materials designs and built in accordance with the best practices of the industry.

C. Each item of equipment shall be listed by Underwriters Laboratories (UL) or approved by Factory Mutual (FM). Each major item of equipment shall bear the manufacturer's name or trademark; serial number, and UL or FM label.

D. Reference Publications: NFPA 13, NFPA 14, NFPA 20, NFPA 24, NFPA 25, NFPA 72, NFPA 101.

1.4 SUBMITTALS

A. Midwestern State University Project Representative shall review and distribute all submittals for approval by IRI, the State of Texas Fire Marshal, and others as appropriate.

B. The State of Texas Fire Marshal has final authority of approval of the Sprinkler System.

C. All product data shall be submitted under provisions of Division 00.

D. Manufacturer's data sheets shall be provided for all materials and equipment for approval before purchase or installation. Data sheets shall describe the type of material, capacities, manufacturer, and part numbers of equipment and give information necessary for checking equipment approval.

E. The Contractor shall submit detailed and accurate shop drawings prepared in accordance with NFPA 13, NFPA 14, NFPA 20 and NFPA 24 for approval of all equipment to be constructed and installed. Shop drawings shall identify all materials and list all equipment to be used. Shop drawings shall include ceiling grid or reflective ceiling layout and have been coordinated with other trades prior to submittal.

F. Hydraulic calculations shall comply with NFPA 13 and shall include comprehensive hydraulic data sheets. Verification of the adequacy of water pressure and other pertinent water supply data shall be the responsibility of the design engineer. The design engineer shall immediately notify the State of Texas Fire Marshal and Architectural and Engineering Services (A&E Services) of the need for supplemental water supply or fire pump or the need for any special considerations required. The engineer shall provide the record data at the point of the new utility connection as follows:

1. Building Name and flange elevator (ft):

2. Test hydrants (hydrant number and location and hydrant elevation (ft)

3. Flow rate (gpm), static pressure (psi), and residual pressure (psi)

G. No work shall be performed until the shop drawings, calculations and data sheets have been approved by Architectural and Engineering Services. The contractor is solely liable for any work performed prior to this approval.

PART 2 - PRODUCTS

2.1 PIPING

A. All piping shall be a minimum schedule 40 steel pipe. All exposed pipe shall be painted (unless prohibited by code).

B. Mechanical Grooved Couplings:
Malleable iron housing clamps: ASTM A47; UL labeled; engage and lock, designed to permit some angular deflection, contraction, and expansion, galvanized couplings for galvanized pipe.

1. “C” shaped composition-sealing gasket: ASTM D2000.

2. Steel bolts, nuts and washers: ASTM A183 heat-treated with a minimum tensile strength of 110,000 psi.

C. Connection shall be made to Midwestern State University Campus on-site water system unless the Owner agrees to an alternate arrangement. The connection between system piping and underground piping shall be made with a cast iron flanged piece, properly fastened.

D. Piping shall be concealed in areas with drop ceilings. Sprinklers shall generally be centered in ceiling tiles.

E. Piping shall be installed in a craftsman like manner and shall not interfere in the complete function of other systems such as cable trays, access panels, or pedestrian passageways. Installation of all piping shall be in coordination with duct, light fixture, and any other work that may obstruct sprinklers. The contractor shall coordinate with all trades having materials in above ceiling spaces prior to commencement of any work.

F. All piping installed outside or otherwise exposed to freezing weather, shall be externally galvanized. Antifreeze loops are not permitted. Piping shall be painted red, and the galvanized surface shall be properly prepped prior to painting to insure bonding.

2.2 VALVES

A. Unless specified otherwise, all valves shall be UL listed or FM approved and be suitable for the anticipated pressures or a minimum of 175 psi working pressure, whichever is greater

B. All valves on connections to water supply to sprinklers shall be UL listed butterfly type indicating valves except for the following which shall be O.S.& Y:

1. All indicating valves on the supply side of the backflow preventer;

2. The indicating valve immediately adjacent to the backflow preventer on the system side.

3. All indicating valves on the suction side of a fire pump.

4. Where indicated on the contract drawings.

C. All butterfly valves shall have a built in tamper resistant switch for supervision of the open position. The switch shall be contained within a NEMA Type 1, general purpose indoor rated housing. Either unauthorized removal of the switch housing (when the valve is open) or closing the valve, shall cause the switch contacts to change position. The switch shall have four conductors to accommodate connections to Style 4 or Style 6 signaling line circuit devices.

D. Where OS&Y indicating valves are installed, the following shall apply:

1. Valves 2-1/2 inches and larger shall be iron body, except seats, discs, and stems which shall be brass. Valves 2 inches and smaller shall be brass body and brass stem seat.

E. A check valve shall be installed between each floor (isolation) control valve and the floor drain valve to permit draining of only the floor (area) affected. Check valves shall comply with the following:

1. Check valves 2-1/2 inches and larger shall be iron body swing check with cast brass hinge, rod, and brass faced discs.

2. Check valves 2 inches and smaller shall be UL listed brass body and all brass fitted.

F. Ball valves shall be constructed of forged brass with Teflon seats and shall be provided with a vinyl-covered handle.

G. Post Indicator Valve - Gate valve on incoming water service shall be operable by a UL listed post indicator valve.

H. All valves controlling water supply for sprinklers shall be readily accessible for use by emergency and maintenance personnel.

I. All accessible valves controlling water supply for sprinklers shall be supervised by the fire alarm system. All valves controlling water supply for sprinklers shall be red in color.

J. A valve shall be installed at the base of each riser.

## 2.3 PIPING ACCESSORIES

A. All hanger components other than all thread shall be UL listed or FM approved. No sprinkler piping is to be supported from any mechanical or electrical devices and/or equipment (ducts, lights, etc.). Hanger assemblies installed outside, or otherwise exposed to weather, shall be externally galvanized.

B. Install iron pipe sleeves of ample diameter at all points where pipes penetrate beams, floors or walls. Size and install so that sprinkler pipes are not stressed.

a. Where sleeves penetrate rated walls or partitions, provide appropriately rated fire stop caulk around the sleeves as well as internal to the sleeve to the penetrating pipe.

C. Sleeves shall be installed prior to construction of walls or pouring of concrete. Install sleeves flush with all surfaces.

D. Sleeves for underground pipe shall have mechanical rubber seals and be watertight, equal to GPT Industries 'Link-Seal'.

E. Floor, wall and ceiling escutcheons/plates shall be pressed steel or cast iron split plates, chrome plated.

F. Pressure gauges shall be UL listed or FM approved for fire service.

2.4 SPRINKLERS

A. Sprinklers shall be UL listed or FM approved. Any sprinkler that incurs damage, is painted, or is sprayed with any obstructive material shall be replaced at no cost to the Owner. Installation of sprinklers shall be coordinated with other work including duct and electric fixture installation to prevent sprinkler obstructions.

B. Sprinklers that may be subject to mechanical damage shall be provided with guards listed by UL and IRI approved for the model of sprinkler used.

C. Quick response sprinklers are required throughout all light hazard occupancies and encouraged throughout ordinary hazard occupancies.

D. All sprinklers shall be concealed type including sidewall sprinklers.

2.5 FIRE DEPARTMENT CONNECTIONS

A. Each fire department connection shall be the flush type. Freestanding type fire department connections shall only be installed when approved by A&E Services and the Wichita Falls, Texas Fire Marshal. Each fire department connection shall be two (2) 2-1/2 inches, equipped with UL listed screw caps with pin lugs and chains. The fire department connection shall be labeled "AUTOMATIC SPRINKLER" with raised letters at least one inch in size and cast on plate. The fire department connections shall be not less than two feet and not more than 3 feet 6 inches in elevation, measured from the ground level to the centerline of the inlets.

B. A bypass with a normally closed valve shall be installed around the check valve in the fire department connection piping, to permit flow testing of the backflow prevention assembly.

2.6 IDENTIFICATION TAGS

Identification signs shall be porcelain enameled 18 gauge and shall be affixed securely by brass chain to all valves. The signs shall be red in color.

A. Provide an approved laminated valve chart in frame and plexiglass cover showing location and use of each valve. The chart shall be secured in a visible location acceptable to Midwestern State University near the system riser.

B. The main drain sign shall be labeled "MAIN DRAIN". Riser drains shall be labeled "RISER DRAIN" or "DRAIN".

C. Auxiliary drain signs shall be labeled "AUXILIARY DRAIN".

D. Inspector's Test signs shall be labeled "INSPECTOR'S TEST".

E. All water supply control valves shall have a standard sign identifying the portion of the system controlled, noting that the valve shall be kept open, and leaving a blank space for notification information.

F. All isolation valves shall be marked “normally open” (NO) or “normally closed” (NC).

2.7 DRAINS AND TEST PIPING

A. All risers, including the alarm check valve, shall be equipped with drains with sizes as specified in NFPA 13. The alarm checks valve drain (“main drain”) shall be piped to the sanitary sewer system.

B. Every waterflow switch shall have an-inspector’s test connection piped in accordance with item 2.10C of this Standard.

C. All drains and test piping shall be piped to the sanitary sewer system.

2.8 BACKFLOW PREVENTER

A. A double check backflow prevention assembly with OS&Y valves shall be installed in the water supply to each automatic fire protection system.

2.9 STANDPIPE SYSTEMS

A. The Standpipe and hose cabinet shall be reviewed and approved by State of Texas Fire Marshal, as well as, the City of Wichita Falls Fire Marshal.

B. Wet standpipe systems shall be the manual-wet type and Class 1 as defined by NFPA 13.

C. Each standpipe shall be installed with a UL listed 2-1/2 inch NST fire department hose connection with screw caps on each floor in an accessible, protected; and readily visible location in accordance with NFPA 13.

D. Each standpipe shall have a drain sized and located in accordance with NFPA 13. Each drain shall be discharged to sanitary sewer.

E. Standpipe Valves and Hose are to be located on each floor of building.

1. Approved Product or equal: Larsen, FS0-3232, solid door, lettering black, horizontal, stainless steel, satin finish.

PART 3 - EXECUTION

3.1 GUARANTEE

The Contractor shall guarantee and service all workmanship and materials to be as represented by him, and shall repair or replace, at no additional cost to the Owner, any part thereof which may become defective within the period of three (3) years after the date of final acceptance by the Engineer, ordinary wear and

tear excepted. Contractor shall be responsible for, and pay for, any damages caused by, or resulting from defects in his work.

## 3.2 QUALIFICATIONS

System design and installation shall be supervised by a licensed NICET Level III sprinkler system technician or fire protection engineer with not less than five (5) years experience with sprinkler systems. Shop drawings shall be prepared and engineered. Accurate As-Built drawings shall be required in the form of three hard copies and two copies on CD in the specified format. The signature of the RME or engineer constitutes an affidavit that the statements, representations, and information presented in the submittal constitute a complete operational system conforming with applicable state laws and recognized good engineering practices. All field installation work shall be continuously supervised by a NICET Level II or III sprinkler system technician.

## 3.3 CERTIFICATION

A. Fire system is to be certified to the State Fire Marshal by the installing licensed fire alarm firms.

B. Copy of certification shall be included in fire alarm panel and owner's manual.

C. Proof of transmitting certificate to State Fire Marshal shall be provided to owner and A/E. Contractor shall transmit via Certified Mail Return Receipt and shall include original copy of receipt to owner's proof of submission as part of the Final Owners Operating and Maintenance Manuals.

END OF SECTION 21 10 00

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# 22 00 00 - PLUMBING GENERAL SYSTEM DESIGNS

## PART 1 - GENERAL

### 1.1 SCOPE OF STANDARDS:

A. Plumbing Code Compliance: Comply with applicable portions of the latest edition of the International Plumbing Code, to selection and installation of Plumbing materials and products.

B. The design guidelines contained herein include the requirements for systems, materials, fittings and valves utilized for plumbing systems at Midwestern State University. It is the intention of this document to provide a standard for piping systems at Midwestern State University in order to provide the highest level of quality and standardization possible; it is not intended to be a guide specification.

C. Refer to the related Plumbing Specification sections as they relate to items contained herein.

D. All personnel performing plumbing work shall be registered and in compliance with Texas State Board of Plumbing Examiner regulations.

E. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

### 1.2 DESIGN GUIDELINES

A. General

1. Seal all openings around piping. Provide GPT Industries ‘Link-Seal’ as required for a water tight seal.

2. Provide metal sleeves for piping passing through walls to provide fire protection equivalent to initial requirements.

3. In lavatories separately valve each riser pipe.

4. Hose bibs shall be equipped with a factory installed vacuum breaker.

5. Use pipe unions at each valve wherever possible.

6. Provide adequate clean out points for DWV piping.

   a. Provide access panels if cleanouts are installed above inaccessible ceilings. Coordinate with General Contractor.

7. Provide all take-offs from main water supply lines with cutoff valves and provide sufficient clearance for access to valves.

   a. Provide access panels if cleanouts are installed above inaccessible ceilings. Coordinate with General Contractor.

8. Provide enough valves so that plumbing systems can be closed down in sections and the system can remain in service.

9. Provide permanent “as-constructed” drawings which show locations of all piping systems, including those underground.

10. Use an identification system and a color coding system for plumbing and piping systems as described in mechanical section of these standards.

11. Provide keyed hose bibs no more than 100' apart around outside perimeter of a new building. Outdoor hose bib shall be non-freeze proof type.

12. All valves concealed within enclosing construction shall be made accessible via appropriate metal access doors. Their location and size shall be provided to the architect/engineer with a record document to be signed off on.

13. Piping identification standard is ANSI A13.1 "Scheme for Identification of Piping Systems".

    a. All piping shall have flow arrows indicating direction of flow.

B. FLOOR DRAINS

1. Provide floor drains, minimum 4", in all restrooms and custodial closets.

    a. Do not provide floor drains in elevator pits, these areas will be protected with a sump pump.

2. For drains in Restroom/Bathroom for Public use, provide minimum 3" pipe size. Large restrooms may require 2 or more floor drains.

3. Slope floor to drains, the area should be graded so that the area can be protected by the fixture.

4. Trap primers will not be allowed.

5. All pressure relief type trap primary devices shall be connected to a direct drop that supplies a single fixture.

6. All traps that are remote from a commonly used fixture shall have adequate room for priming in the event it should go dry.

7. Floor drains in mechanical rooms shall be accessible and not located underneath equipment. Drains should be located where mechanical maintenance spillage may be expected such as pump pads, AHU coils, water heaters, condensate receivers, etc.

8. Pipe condensate drain lines to floor or hub drain in immediate area. Do not extend drain piping across an aisle area. Do not use a plumbing fixture as drain. Grade pipe lines to drains with the lowest end pointed in the direction of flow.

C. FLOOR SINKS

1. Provide 16' X 16" floor sinks in Mechanical Rooms.

2. There shall be one 16" X 16" floor sink with 4" outlet pipe size per air handler for fin water (condensate from cooling coils), and one 12"x12" floor sink per pump battery to facilitate multiple condensate lines, and to eliminate trip hazard of condensate lines routed over floors.

D. PIPE CHASES

1. Size pipe chases to be large enough to accommodate the piping to be housed in chases and to be accessible. Locate piping in chases to avoid the obstruction of entrances or openings to pipe chases.

a. Minimum pipe chase width is 42”.

E. ACCESS TO PLUMBING

1. Equip access doors with locks keyed to campus master and grand master key.

2. Provide adequate space for working on plumbing and piping.

3. Afford easy access to all working parts of all plumbing devices.

4. Do not permanently seal in masonry wall those items of plumbing requiring periodic maintenance or repair.

5. Pipes should not be run above electric panels, transformers, etc.

F. PRESSURE GAUGE

1. Include a 1-100 psi pressure gauge, 4-inch or larger, on the domestic water header.

2. Also include an electronic pressure sensor on the header, suitable for connection to Owner’s monitoring system.

G. PIPE SIZE

1. Avoid 3-1/2 and 5-inch pipe.

H. SOLDER

1. Shall be of lead free material as specified in the International Plumbing code.

2. Pro Press systems are acceptable.

I. FIN WATER

1. Fin water may be recovered in some buildings.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURE STANDARDIZATION:

A. Provide only floor mount, floor outlet water closets.

B. Standardize plumbing fixtures for Midwestern State University as much as possible.

C. With each new construction project verify plumbing fixture selections with Project Manager prior to ordering and finalizing the specification of plumbing fixtures.

D. Specify plumbing fixtures which have been established as Midwestern State University standards.

E. Refer to plumbing section for standard plumbing products.

F. For energy conservation, where water saving devices have been developed and proven, such as reduced flow shower heads, they shall be used.

G. Faucets shall be Delta single handle.

H. Shower valves shall be Delta single handle scald guard with stops.

2.2 PIPING SPECIALTIES

A. General: Midwestern State University Standards dictate factory-fabricated piping specialties recommended by manufacturer for use in service indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide with fittings coordinated to properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option, after review with Midwestern State University Project Manager.

2.4 INSTRUMENTATION AND MISCELLANEOUS PIPING TAPS—WATER SYSTEMS BELOW AMBIENT TEMPERATURE

A. All taps shall be constructed of ¾" Schedule 80 Thread-o-Let, ¾" 304/316 stainless steel nipples, and ¾" bronze gate valve.

2.5 BASIC SUPPORTS AND ANCHORS

A. General: Provide supports and anchors in accordance with the following listing:

1. Adjustable galvanized steel clevises and adjustable pipe saddle supports are Standard for horizontal piping hangers and supports.

2. Two-bolt riser clamps are Standard for vertical piping supports.

3. Concrete inserts, C-clasps, and steel brackets are Standard for building attachments.

4. Protection shields are Standard for insulated piping support in hangers.

2.5 THERMOMETERS

A. Provide Solar-Powered Digital Thermometers.

B. Thermometers in pipe lines shall be installed in sockets fitted into piping by the use of tees, or elbows, or welded into pipe 3" or larger, to permit bulb socket to enter into the pipe stream, and allowance shall be made in necks of thermometers for insulation where same is used.

C. Thermometers shall be provided in inlets and outlets to each water-cooled condenser, inlets and outlets to each chiller, inlets and outlets to each water coil, common cooling tower supply and return lines, common chilled water supply and return lines, in each zone supply duct at each air handling unit and at any other location indicated on the drawings.

D. Thermometers shall have a calibration adjustment and same be accurately calibrated.

PART 3 - EXECUTION

3.1 GENERAL

A. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

1. Provide clean-out capability for domestic hot water return piping in recirculating loops. There may be a capped "tee" at each ninety-degree turn in the piped return system.

3.2 INSTALLATION OF VALVES

A. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two or more plumbing fixtures or equipment connections.

B. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture.

C. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain potable water system.

D. Check Valves: Install on discharge side of each pump.

E. Balance Cocks: Install in each hot water recirculating loop.

F. Hose Bibbs: Install on exposed piping where indicated, with vacuum breaker.

G. Sill Faucets: Install on concealed piping where indicated with vacuum breaker.

H. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

I. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

J. Selection of Value Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or type of pipe/tube connections.

K. Tube Size 2” and Smaller: Soldered-joint valves.

L. Pipe Size 2-1/2” and Larger: Flanged valves.

M. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OSY valves.

N. Non-Metallic Disc: Limit selection and installation of valves with non-metallic discs to locations indicated and where foreign material in piping system can be expected to prevent tight shut-off metal seated valves.

O. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

3.3 INSTALLATION OF PRESSURE REGULATING VALVES

A. Provide inlet and outlet shutoff valves, and throttling valve bypass. Provide pressure gage on valve outlet.

3.4 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by the International Plumbing Code.

B. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated, and comply with equipment manufacturer’s installation instructions. Provide shutoff valve and union for each connection, provide drain valve on drain connection.

3.5 ADJUSTING AND CLEANING:

A. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.

B. Cleaning: Clean factory-finished surfaces. Repair marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 22 00 00

# SECTION 22 00 10 - GENERAL REQUIREMENTS FOR PLUMBING WORK

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. The General Requirements for Plumbing Work are intended to be complementary to the General Requirements of the Construction Contract.

B. Work Included: Provide complete plumbing systems where shown on the drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to the following summary of work:

1. Provide a complete plumbing system as shown on the plans.

2. Domestic hot water shall be supplied from hot water generators provided by the Mechanical Contractor.

3. Provide a hot water recirculation system.

4. Route storm drain to rainwater harvesting tanks provided by Landscape Architect.

5. Other items and services required to complete the systems.

### 1.2 QUALITY ASSURANCE AND APPLICABLE STANDARDS

A. Use adequate numbers of skilled workers that are thoroughly trained and experienced in the necessary crafts and are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Architect/Engineer/Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. Codes: Perform all work in accordance with the latest edition of the following codes:

1. State and city building, fire, plumbing, and mechanical codes.

2. National Electrical Code (NEC)

3. National Fire Protection Association (NFPA)

4. American with Disabilities Act (ADA)

5. Texas Accessibility Standards (TAS)

6. All authorities having jurisdiction.

D. Where conflicts occur between drawings, specifications, and code requirements, the most stringent requirement shall take precedence.

E. Standards: The specifications and standards of the following organizations are by reference

made a part of these specifications. All work, unless otherwise indicated, shall comply with the requirements and recommendations wherever applicable:

1. American National Standards Institute (ANSI)
2. Air Conditioning and Refrigeration Institute (ARI)
3. American Gas Association (AGA)
4. American Society for Testing and Materials (ASTM)
5. American Society of Mechanical Engineers (ASME)
6. American Society of Plumbing Engineers (ASPE)
7. American Society of Refrigeration, Heating and Air Conditioning Engineers (ASHRAE)
8. Electrical Testing Laboratories (ETL)
9. National Bureau of Standards (NBS)
10. National Electrical Manufacturer's Association (NEMA)
11. National Fire Protection Association (NFPA)
12. Sheet Metal and Air Conditioning National Association (SMACNA)
13. Underwriters Laboratories, Inc. (UL)

F. Electrical Characteristics for Equipment: Equipment of differing electrical characteristics may be furnished provided such equipment is proposed on the “Alternate Manufacturer Evaluation Form”, subsequently approved, and connecting electrical services, circuit breakers, and conduit sizes appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

G. When requested, provide the Owner’s Authorized Representative with manufacturer’s certificate that materials meet or exceed minimum requirements as specified.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. The requirements and recommendations of the latest edition of the Occupational Safety and Health Administration (OSHA) Act are by reference made a part of these specifications. All work shall comply with the requirements and recommendations wherever applicable.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. All Other Sections of Divisions 21, 22, 23 and 26 (as applicable).

B. All other divisions of the contract documents. Refer to each division's specifications and drawings for all requirements

1.5 SUBMITTALS

A. Comply with pertinent provisions of Division 01.

B. Provide Specifications per Division 01 for all submitted alternate equipment.

Product Data: Submit the following:

1. Materials list of items proposed to be provided under Division 22.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in the following paragraph.

3. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Architect/Engineer/Owner can **easily** determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Organize in a clear and concise format. All substitutions shall be approved in writing by Architect/Engineer. The Architect/Engineer’s decision shall be final.

4. Allow a minimum of ten (10) working days for the review of submittals and each re-submittal.

5. Compliance with the Contract documents shall be the sole responsibility of the Contractor. Items on equipment that are were not accepted by the Architect/Engineer in writing as an approved equal shall be replaced or revised to comply with the contract documents at the Contractor's expense.

6. Manufacturer's recommended installation procedures which, when reviewed by the Architect/Engineer, shall become the basis for accepting or rejecting actual installation procedures used on the work.

7. Sign the submittal as an indication of compliance with the contract documents. Any deviations from the contract documents shall be indicated on the submittal prior to signing. Any deviations not indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor’s expense.

C. Submittals required of materials and equipment under this section include the following:

1. Piping and Accessories Materials

a. Clearly marked up manufacturer's data showing compliance with the specifications for:

1) Piping material proposed for each system.

2) Valves, cocks, and specialties.

3) Flanges.

b. l/8" scale (minimum) sanitary sewer, domestic hot and cold water, natural gas, and storm piping shop drawings showing coordinated piping routing and arrangements with all equipment, accessories and system expansion and

contraction compensation methods.

2. Identification Materials

   a. Clearly marked-up product literature or samples showing compliance with specified materials for:

      1) Valve tagging.

      2) Pipe marking.

      3) Equipment marking.

3. Insulation

   a. Manufacturer's certified data on thermal performance.

   b. Details, when required, of methods to be used in providing for unusual piping expansion and contraction.

   c. Manufacturer's product data and application information on heat tracing system including all electrical requirements.

   d. Manufacturer's data on any alternate insulation material of reduced thickness, including pre-insulated pipe.

   e. Manufacturer's data on all jacketing materials, sealants and fasteners.

4. Pumps

   a. Provide factory certified performance curve clearly marked with the operating point of each pump.

   b. Provide manufacturer's data on all panels, accessories, and specified factory options.

   c. Provide all electrical characteristics.

5. Plumbing Materials

   a. Clearly marked-up manufacturer's data showing compliance with the specifications on:

      1) Fixtures, carriers and all accessories.

      2) Plumbing equipment.

      3) Water hammer arresters.

      4) Backflow preventers.

      5) Thermostatic mixing valves.

      6) Natural gas pressure regulators.

7. Record Documents: Reference the requirements detailed in this section.

8. Operation and Maintenance Data: Reference the requirements detailed in this section.

D. Resubmittals of rejected submittals shall be limited to one (1) in number. Costs for processing subsequent resubmittals in excess of the first resubmittal, resulting from the Contractor's disregard of Architect/Engineer's primary submittal rejection comments, shall be borne by the Contractor. Costs shall be based on Architect/Engineer's hourly rates as published in their current professional fee schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost plus fifteen percent (15%).

E. Shop Drawings: Upon written request of the Contractor, the Architect/Engineer will provide directly to the Contractor electronic backgrounds of drawings required to produce shop drawings. The requirements to secure electronic files for shop drawing purposes are the same as for record drawing purposes. See 220010, Paragraph 1.15.H.2.

1.6 SUBSTITUTIONS

A. The use of manufacturers' names and catalog numbers followed by the phrase "or equal" is generally used to establish a standard of quality and utility for the specified items and to provide a dimensional reference for construction documents that are drawn to scale.

B. Submittals for "equal" items shall, where applicable, include the following data that are not necessarily required for specified items:

1. Performance characteristics.

2. Materials.

3. Finish.

4. Certification of conformance with specified codes and standards.

5. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in Paragraph 6 below.

6. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Architect/ Engineer/Owner can **easily** determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Include shop drawings for all piping and plumbing equipment per Paragraph 1.5 Submittals. Organize in a clear and concise format.

C. Submittals of "equal" components or systems may be rejected if:

1. The material or equipment would necessitate the alteration of any portion of the plumbing, mechanical, electrical, architectural or structural design.

2. Dimensions vary from the specified material or equipment in such a manner that accessibility or clearances are impaired or the work of other trades is adversely affected.

D. Proposed substitutions for materials or equipment must be submitted ten (10) days **prior** to final bid date for consideration as approved equals. Otherwise, such substitutions will not be permitted. **Only** Prime Bidders are allowed to make proposals for substitutions. Manufacturers, distributors, and sub-contractors shall **not** make proposals to the Architect/Engineer for substitutions.

E. No substitution shall be made unless authorized in writing by the Architect/Engineer. Should a substitution be accepted, and should the substitute material prove defective or otherwise unsatisfactory for the service intended, and within the guarantee period, replace this material or equipment with material or equipment specified, at no additional cost to the Architect/Engineer/Owner, and to the satisfaction of the Architect/Engineer.

F. Contractors submitting bids on substitute materials and equipment must also provide a written performance guarantee certifying that the substitute materials and equipment will produce the specified effects and meet the approval of the Architect/Engineer.

1.7 ORDINANCES, PERMITS, METERS, UTILITIES, AND ROYALTIES

A. Procure all permits and licenses necessary for completion of this project and pay all lawful fees required and necessary pursuant in obtaining said permits and licenses. All required certificates of approvals and inspections by local governing and regulating authorities shall be obtained and paid for by the Contractor.

B. Pay all fees required for the connection of water, gas, and sewer to utility mains, and any meter fees if required.

C. Pay any royalty payments required or fees for the use of patented equipment or systems. Defend all law suits or claims for infringement of any patent rights and shall hold the Owner and Architect/Engineer harmless from loss as a result of said suits or claims.

1.8 COMPATIBILITY OF EQUIPMENT

A. Assume full responsibility for satisfactory operation of all component parts of the plumbing systems to assure compatibility of all equipment and performance of the integrated systems in accordance with the requirements of the specifications. Should the Contractor consider any part of the specifications or drawings as rendering his acceptance of such responsibility impossible, prohibitive, or restrictive, he shall notify the Architect/Engineer before submitting his bid, and the bid shall be accompanied by a written statement of any objections or exceptions to the specifications and drawings.

1.9 EXISTING UTILITIES AND TEMPORARY SERVICES FOR CONSTRUCTION

A. Verify the location and capacity of existing utility services pertaining to work of Division 22. Relocate existing utilities unearthed by excavation as directed by the utility service companies affected.

B. Temporary Services for Construction

1. Provide temporary services in strict accordance with the provisions of these specifications.

1.10 EXCAVATION AND BACKFILLING

A. Perform all excavation and backfilling necessary for the installation of the work. This shall include

shoring and pumping in ditches to keep them in dry condition until the work has been installed. Properly perform all shoring required to protect the excavation and to safeguard employees.

B. Perform excavation and backfilling in strict accordance with the provisions of these specifications including trench safety requirements.

C. Make all excavations to the proper depth, with allowances made for floor slabs, forms, beams, etc. Properly compact ground under piping before installing piping.

D. Provide backfilling with selected soil, free from rocks and debris and pneumatically tamp with 6-inch layers to secure a field density ratio of 95 percent as defined by ASTM Designation D698-57T (Proctor Soil Compaction Test).

E. Remove from the site, excavated materials not suitable and not used in the backfill.

F. Field check and verify the locations of all underground utilities. Avoid disturbing these as far as possible. In the event existing utilities are damaged, repair them at no cost to the Architect/Engineer/Owner.

G. In a lime-stabilized area, fully restore the lime stabilization after the excavation is complete.

H. Replace concrete, curbs, paving, and other surface improvements cut during excavation to their original condition.

1.11 JOBSITE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Include required work to correct conditions detrimental to the timely and proper completion of all Division 22 Work. Do not proceed until unsatisfactory conditions are corrected.

1.12 PREPARATION AND COORDINATION

A. Perform coordination work in strict accordance with provisions of these specifications and the following:

1. Coordinate as necessary with other trades to assure proper and adequate interface with all work.

2. Where pipes and other plumbing items are shown in conflict with locations of structural members and other equipment, include labor and materials required for extensions, offsets and supports to clear the encroachment.

3. Although such work is not specifically indicated, provide all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation.

4. Coordinate accepted equipment changes from those scheduled or specified with other trades affected. Additional compensation to other trades for equipment changes is the responsibility of the Contractor making the change.

B. Plumbing Drawings are diagrammatic. Follow the drawings as closely as actual construction and work of other trades will permit. Piping arrangements have been designed for maximum economy consistent with good practice and other considerations. Install the systems arranged as shown on the drawings, except as otherwise approved in advance by the Architect/Engineer.

C. Data indicated on the Drawings and in these Specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels, and other conditions will be governed by actual construction and the Drawings and Specifications should be used only for guidance in such regard.

D. Where items such as clean outs and access panels are not specifically located on the Drawings, provide an RFI to the Architect/Engineer, and locate as determined in the field by the Architect/Engineer. Where such items are installed without such specific direction, relocate as directed by the Architect/Engineer, and at no additional cost to the Architect/Engineer/Owner.

E. Verify all dimensions and distances. No additional compensation will be allowed because of differences between work shown on the Drawings and actual dimensions and distances at the jobsite.

1.13 CONSTRUCTION REQUIREMENTS

A. The drawings show the arrangements of work. Should project conditions necessitate rearrangement, or if the materials or equipment can be installed to a better advantage in a different manner, before proceeding with the work, prepare and submit five copies of Drawings of the proposed arrangement for the Architect/Engineer's review. Allow a minimum of ten (10) working days for review.

B. Should the Contractor propose to install equipment requiring space conditions other than those shown, or rearrange the equipment, he shall assume responsibility for the rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such changes shall be accompanied by contractor-generated detailed shop drawings of the space in question. Identify monetary credits proposed or other benefits of the change. Allow a minimum of ten (10) working days for review.

C. Properly locate and size all slots, holes, and openings in the building structure pertaining to the work and for the correct location of pipe sleeves, duct sleeves, fire dampers, etc., as applicable to the work.

1.14 CUTTING AND PATCHING

A. Perform cutting and patching associated with the work in strict accordance with the provisions of Division 1 of these Specifications and the following:

1. Coordinate work to minimize cutting and patching work.

2. Request for Architect/Engineer's Consent

a. Prior to cutting or coring of the building structure, submit a written request to the Architect/Engineer for permission to proceed with cutting. Include x-rays of any floor area where cutting or coring is proposed.

b. Contractor is cautioned that concrete floor may contain steel tendons, pipes, and electrical/telecom conduits, all of which can not be cut or damaged.

3. Perform Architect/Engineer-approved cutting and demolition by methods that will prevent damage to other portions of the work and provide proper surfaces to receive installation of new work and repair.

4. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.

5. Provide all core drilling of holes. Where sleeves and blockouts are required, they shall be cut or provided at locations required. On completion of this work or as work progresses, make all repairs and do all patching required as a result of work under this Contract. All patching shall be performed in a manner that will restore the surrounding work to its original condition to the satisfaction of the Architect/Engineer.

6. Assume responsibility for the proper size of all sleeves and blockouts in the building structure pertaining to the work and for providing the correct location of pipe sleeves and blockouts.

7. Where openings are cut through masonry walls, provide lintels or structural supports to protect the remaining masonry. Provide adequate support during the cutting operation to prevent any damage to the affected masonry.

1.15 PROJECT RECORD DOCUMENTS

A. Provide the record documents associated with the work of Division 22 in strict accordance with the provisions of these specifications.

B. Throughout progress of the Division 22 Work, maintain an accurate record of changes in the Contract Documents that apply to work of Division 22. Changes shall include all addendums issued during bidding. Maintain an accurate record of the location of plumbing service lines and outlets and all outside utilities.

C. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Architect/Engineer. Submit in writing at the pre-construction conference the name and credentials of the person responsible for record mark-ups and maintenance.

D. Accuracy of Records

1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of drawings and other documents where such entry is required to show the change properly. Match the symbology and format of the base documents.

2. Accuracy of records shall be such that a future verification of items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

E. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of all recorded data to the final Project Record Documents.

F. Making Entries on Drawings

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.

2. Date all entries.

3. Call attention to the entry by a "cloud" drawn around the area or areas affected.

4. In the event of overlapping changes, use different colors for the overlapping changes.

5. Make entries within 24 hours after receipt of information that the change has occurred.

6. Maintain the base drawing format and use the same symbology.

7. Convert field mark-ups to finished CADD record drawings when required in this section.

G. Conversion of Schematic Layouts

1. In some cases on the drawings, arrangements of equipment and piping and similar items are shown schematically and are not intended to portray precise physical layout. Determine final physical arrangement subject to the Architect/Engineer's approval. However, design of future modifications of the facility may require accurate information as to the final physical layout of items that are shown only schematically on the drawings.

2. Show on the job set of record drawings, by dimension accurate to within one inch, the centerline of each run of items such as all sleeves and piping, etc., below grade, in walls, or in the concrete slab. A surface mounted device indicates the exact location:

a. Clearly identify the item by accurate note such as "Sanitary Sewer" and the like.

b. Show, by symbol or note, the vertical location of the item "under slab," "in ceiling plenum," "exposed," and the like.

c. Make all identification sufficiently descriptive that it may be related reliably to the specifications.

H. Final Project Record Documents

1. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.

2. Provide CADD electronic files in ".dwg" Format using AutoCAD Release 2012 software (minimum). Upon written request and completion of a release form, the Engineer will provide AutoCAD Release 2012 electronic files of base Contract Drawings in dwg format. The Engineer will also provide a list of drawing layers and names that shall be maintained.

3. Provide completed record drawings on CD and one reproducible full-size sheet of each drawing.

4. Refer to Section 017700 for additional requirements.

1.16 OPERATION AND MAINTENANCE DATA

A. Well before substantial completion, submit two copies of a preliminary draft of the proposed manual(s) to the Architect/Engineer for review and comments. Allow a minimum of ten (10) working days for review.

B. Submit specified number copies of the approved manual to the Architect/Engineer prior to indoctrination of operation and maintenance personnel.

C. Prepare in accordance with the following standards:

**Format:**

Size: 8½" x 11"

Paper: White bond, at least 20 lb. weight

Text: Neatly written or printed

Drawings: 11" in height preferable; bind in with text; foldouts acceptable; larger drawings are acceptable but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.

**Flysheets:** Separate each section of the Manual with neatly prepared flysheets briefly describing contents of the ensuing section; flysheets may be in color.

**Binding:** Use heavy-duty plastic or fiberboard covers with binding mechanism concealed inside the manual; 3-ring binders will be acceptable; all binding is subject to the Architect/ Engineer's approval.

**Measurements:** Provide all measurements in U.S. standard units such as feet-and-inches, lbs, and cfm. Where items may be expected to be measured within ten years in accordance with metric formulae, provide additional measurements in the "International System of Units" (SI).

D. Provide front and back covers for each manual, using durable material approved by the Architect/Engineer, and clearly identified on or through the cover with at least the following information:

1. OPERATING AND MAINTENANCE INSTRUCTIONS

   a. Name and Address of Work

   b. Name of Contractor

   c. General subject of this manual

   d. Space for approval signature of the Architect/Engineer and approval date

E. Contents: Include at least the following:

1. Neatly typewritten index near the front of the manual, giving immediate information as to location within the manual of all emergency information regarding the installation.

2. Complete instructions regarding operation and maintenance of all equipment provided including lubrication, disassembly, and reassembly.

3. Complete nomenclature of all parts of all equipment.

4. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.

5. Copy of all guarantees and warranties issued.

6. Manufacturer's bulletins, drawings, and descriptive data, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.

7. Such other data as required in other sections of these specifications.

1.17 EQUIPMENT FOUNDATIONS

A. Provide equipment foundations associated with the work in accordance with the provisions of these specifications.

B. Provide concrete bases for all pad or floor mounted equipment. Bases shall be four inches (4") high above finished floors or grades (unless otherwise noted) and shall protrude two inches (2") beyond all sides of equipment and shall have exposed chamfered edges. Construct bases from ready-mixed hardrock concrete, ASTM C94, reinforced with #3 rebar, ASTM A615, Grade 40, at 18" on center each way.

C. Field verify exact location of outdoor pad mounted equipment with the Architect/ Engineer. Supply necessary fill and grade site to provide natural drainage away from equipment.

1.18 PAINTING

A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be damaged in transit or during the installation, it shall be finished to match appearance of original finish. All work shall be subject to approval by Architect/Engineer.

1.19 TESTING AND INSPECTION

A. Provide personnel and equipment, make required tests, and secure required approvals from the Architect/Engineer and governmental agencies having jurisdiction.

B. Make written notice to the Architect/Engineer, adequately in advance, of each of the following stages of construction:

1. When all rough-in is complete, but not covered;

2. As specified in all Division 22 sections.

3. At the completion of the work of Division 22.

C. When material or workmanship is found to not comply with the specified requirements, remove the noncomplying items from the job site and replace them with items complying with the specified requirements at no additional cost to the Architect/Engineer/Owner. This shall be performed within 3 days after receipt of written notice of noncompliance.

1.20 WARRANTY

A. Warranty all equipment and workmanship for a period of one year after date of substantial completion and replace or repair any faulty equipment or installation at no cost to the Architect/Engineer/Owner for such service during this period, all in accordance with requirements of Division 01.

B. Provide full material warranty on all compressors for a period of five years after date of substantial completion.

C. This warranty shall not void specific warranties issued by manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the Owner by law.

D. Warranties shall be in writing in a form satisfactory to the Owner, and shall be delivered to the Owner before final payment is made.

1.21 PROJECT COMPLETION

A. Upon completion of the work of Division 22, thoroughly clean all exposed portions of the plumbing installation, removing all traces of soil, labels, grease, oil, and other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned.

END OF SECTION 22 00 10

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SECTION 22 01 12 - INTERDISCIPLINARY COORDINATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Refer to Section 220010 – GENERAL REQUIREMENTS FOR PLUMBING WORK

1.2 SUMMARY

A. This Section describes the coordination between the Mechanical, Plumbing, Fire Protection, and Electrical portions of the work.

B. This Section is also included under Divisions 21, 22, 26, and 28 portions of the Specifications.

1.3 WORK INCLUDED

A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. The schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:

| | ITEM | FURNISHED UNDER DIVISION | INSTALLED UNDER DIVISION | WIRED AND CONNECTED UNDER DIVISION |
|---|---|---|---|---|
| 1. | Equipment Motors | Note 9 | Note 9 | 26 |
| 2. | Magnetic motor Starters | | | |
| | a. Automatically controlled, with or without HOA switches. | 26 | 26 | Notes 1,3,5 |
| | b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment. | Note 9 | Note 9 | Notes 1,3,5 |
| | c. Manually controlled | 26 | 26 | Notes 1,3,5 |
| | d. Manually controlled and furnished as part of the factory wired equipment. | Note 9 | Note 9 | Notes 1,3,5 |
| | e. Furnished in motor Control Centers. | 26 | 26 | Notes 1,3,5 |
| 3. | Variable Speed (Frequency) AC Drives. | 23 | 26 | Notes 1,4,5 |
| 4. | Line voltage thermostats, time clocks, etc., not connected to control panel systems. | 23 | 23 | 26 |
| 5. | Electric thermostats, time clocks, remote bulb | 23 | 23 | 23 |

| | | | | |
|---|---|---|---|---|
| | thermostats, motorized valves, float controls, etc. which are an integral part of directly attached to ducts, pipes, etc. | | | |
| 6. | Temperature control panels and time switches mounted on temperature control panels. | 23 | 23 | Note 1 |
| 7. | Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc. | 23 | 23 | Note 1 |
| 8. | Alarm bells furnished with equipment installed by Division 23. | 23 | 23 | 23 |
| 9. | Wiring to obtain power for control circuits, including circuit breaker. | 26 | 26 | 26 |
| 10. | Low voltage controls | 23 | 23 | 23 |
| 11. | Fire protection system (sprinkler) controls. | 21 | 21 | Note 8 |
| 12. | Smoke detectors installed on mechanical units and in ductwork. | 26 | 23 | Note 2 |
| 13. | All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with VAC equipment to provide operation and control of HVAC equipment. | 23 | 23 | Note 1 |
| 14. | Smoke dampers, and combination fire/smoke dampers. | 23 | 23 | Note 7 |
| 15. | Boiler and water heater controls, boiler burner controls panels. | 23 | 23 | Note 1 |
| 16. | Pushbutton stations, pilot lights. | 26 | 26 | 26 |
| 17. | Heat Tape. | Note 9 | Note 9 | 26 |
| 18. | Disconnect switches, manual operating switches furnished as a part from equipment. | Note 9 | Note 9 | Notes 1, 5 |
| 19. | Disconnect switches, manual operating switches furnished separate from equipment. | 26 | 26 | 26 |
| 20. | Multispeed switches. | 23 | 23 | 26 |
| 21. | Thermal overloads. | 23 | 23 | 23 |
| 22. | Control relays, transformers. | 23 | 23 | 23 |
| 23. | Refrigeration cycle, cooling tower and controls. | 23 | 23 | 23 |
| 24. | Tamper switches for fire protection (sprinkler) system. | 21 | 21 | 26 |

| | | | | |
|---|---|---|---|---|
| 25. | Flow and/or pressure switches for fire protection (sprinkler) system. | 21 | 21 | 26 |
| 26. | Fire and jockey pump controllers and automatic transfer switch. | 21 | 21 | Note 6 |
| 27. | Alarm bells or horns for fire protection system. | 21 | 21 | 26 |
| 28. | Generator (underground) fuel tank. | 22 | 22 | - |
| 29. | Generator (underground) fuel tank level indicator. | 22 | 22 | 26 |
| 30. | Generator fuel piping from tank to generator. | 22 | 22 | - |
| 31. | Underground fuel tank leak detection and monitoring system. | 22 | 22 | 22 |

Notes

(1) Power wiring as defined in Section 260519 of the specifications shall be provided under Division 26. Control wiring shall be provided under Division 23.

(2) Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 28 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 and 26 specifications and the Drawings for more specific requirements.

(3) For requirements for magnetic motor Starters, refer to Section 262913 – ENCLOSED CONTROLLERS.

(4) For requirements for Variable Speed (Frequency) AC drives, refer to Section 230514 –VARIABLE-FREQUENCY DRIVES.

(5) Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.

(6) Power wiring from energy source to controllers and automatic transfer switch shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 23 and conform to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.

(7) Division 28 will provide power to all smoke and combination fire/smoke dampers, including control wiring for all such dampers using area smoke detectors.

(8) Wiring for sprinkler system controls to be provided by Division 21. Wiring from devices to Fire Alarm System to be provided by Division 28.

(9) All components provided with packaged equipment shall be furnished and installed by the Contractor providing the equipment.

B. CONNECTIONS: Make all connections to controls that are directly attached to duct, piping, and mechanical equipment with flexible connections.

C. PRECEDENCE

1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.

2. Precedence for pipe, conduit and duct systems shall be as follows:
   a. Building lines
   b. Structural members
   c. Soil and drain piping
   d. Vent piping
   e. Steam piping
   f. Condensate piping
   g. Refrigerant piping
   h. Electrical bus duct
   i. Supply ductwork
   j. Return ductwork
   k. Exhaust ductwork
   l. Chilled water and heating water piping
   m. Automatic Fire Protection Sprinkler Piping
   n. Natural gas piping
   o. Domestic hot and cold water piping
   p. Electrical conduit

D. FINAL INSPECTION AND REPORT

1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical, Fire Alarm, and Temperature Control Contractors, representatives of mechanical and electrical equipment manufacturers whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of the meeting, listing those in attendance, and the companies that they represent shall be filed with the Owner, Architect, and Engineer of Record.

# SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

### 1.3 ACTION SUBMITTALS

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

## PART 2 - PRODUCTS

### 2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **GPT Industries 'Link-Seal'** or comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel Plastic Stainless steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Presealed Systems.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

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, 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. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

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 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.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6 : Sleeve-seal fittings
b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6: Sleeve-seal fittings.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

    a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

    a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 22 0517

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# SECTION 22 0518 - ESCUTCHEONS FOR PLUMBING PIPING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

### 1.3 ACTION SUBMITTALS

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

## PART 2 - PRODUCTS

### 2.1 ESCUTCHEONS

A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

### 2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 05 18

# SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Bronze angle valves.
2. Brass ball valves.
3. Bronze swing check valves.
4. Iron swing check valves.
5. Iron swing check valves with closure control.
6. Iron gate valves.
7. Chainwheels.

B. Related Sections:

1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.
3. Section 221319 "Sanitary Waste Piping Specialties" for valves applicable only to this piping.
4. Section 221423 "Storm Drainage Piping Specialties" for valves applicable only to this piping.

### 1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

D. MSS Compliance: Mark valves in accordance with MSS 25 “Standard Marking System for Valves, Fittings, Flanges and Unions”.

E. ANSI Compliance: For face to face and end to end dimensions of flanged or welded end bodies, comply with ANSI B16.10 “Face to Face and End to End Dimensions of Ferrous Valves”.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 6 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 4 and smaller.

4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 BRONZE ANGLE VALVES

A. Class 125, Bronze Angle Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Hammond Valve.
b. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron.

## 2.3 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Hammond Valve.
d. Jamesbury; a subsidiary of Metso Automation.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.5 IRON SWING CHECK VALVES

A. Class 250, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.

b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Victaulic Company.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 500 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

## 2.6 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Weight-Closure Control:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.Crane Co.; Crane Valve Group; Jenkins Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed, exterior lever and weight.

## 2.7 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.

d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

## 2.8 CHAINWHEELS

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. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to plug valve stems.
3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.
4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for ball and gate valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or gate valves.
2. Throttling Service: Ball valves.
3. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, 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 Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: Two piece, full port, brass with brass trim.
4. Bronze Swing Check Valves: Class 150, nonmetallic disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: Class 250, metal seats.
3. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.
4. Iron Gate Valves: Class 125, NRS.

END OF SECTION 22 05 23

# SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment" for vibration isolation devices.

### 1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

### 1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

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.

1.5 ACTION SUBMITTALS

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

B. 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. Pipe stands.
4. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 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.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
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 Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.
c. Flex-Strut Inc.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut Corporation; Tyco International, Ltd.
g. 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 carbon steel.
7. Metallic Coating: Electroplated zinc.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) 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 (50 mm) 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, zinc-coated steel anchors, 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 STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

## 2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

## 2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

# PART 3 - EXECUTION

## 3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. 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 A 36/A 36M, 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 metal framing 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 (100 mm) 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.

G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

O. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) 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 (DN 100) 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 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) 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.

## 3.2 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.

## 3.3 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.

## 3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

## 3.5 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 (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

## 3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems 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 (DN 15 to DN 750).

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), 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 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
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 (DN 100 to DN 900), 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 (DN 100 to DN 900), 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 (DN 65 to DN 900) 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 (DN 25 to DN 750), 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 (DN 65 to DN 600), 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 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

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 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) 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 up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

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.
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 (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

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.
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 (32 mm).
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-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

# SECTION 22 05 48.13 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Pipe-riser resilient supports.
4. Resilient pipe guides.

### 1.3 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.

C. Delegated-Design Submittal: For each vibration isolation device.

1. Include design calculations for selecting vibration isolators.

### 1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation for plumbing 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.

D. Air-Mounting System Performance Certification: Include natural frequency, load, and damping test data performed by an independent agency.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Ribbed pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.

a. Surface Pattern: Waffle pattern.
b. Infused nonwoven cotton or synthetic fibers.

2.2 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.

b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

## 2.3 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- (13-mm-) thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psig (3.45 MPa)on isolation material providing equal isolation in all directions.

## 2.4 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch- (13-mm-) thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

# 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 033000 "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.

END OF SECTION 22 05 48.13

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# SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.
5. Warning tags.

### 1.3 ACTION SUBMITTALS

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

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

### 1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.

3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus 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. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

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.

## 2.3 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 partially cover 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, 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 1-1/2 inches (38 mm)high.

## 2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) 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.

## 2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

# 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. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Piping identification standard is ANSI A13.1 “Scheme for Identification of Piping Systems”.

2. Label all plumbing piping, including, but not limited to:
   a. Domestic Water Piping.
   b. Condensate, Sanitary Waste, and Storm Drainage Piping.

## 3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; 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. 1-1/2 inches (38 mm), round.

2. Valve-Tag Color:

   a. Natural.

3. Letter Color:

   a. Cold Water: White.

   b. Force Main: Green.

## 3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

# SECTION 22 07 19 - PLUMBING PIPING INSULATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Roof drains and rainwater leaders.
5. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and tapes material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule" 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. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F (454 Deg C) 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 Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide the following:

a. Ramco Insulation, Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products: Subject to compliance with requirements, provide the following:

a. Ramco Insulation, Inc.; Thermokote V.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, provide the following:

a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

## 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. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 739, Dow Silicone.
b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
b. Eagle Bridges - Marathon Industries; 501.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
b. Eagle Bridges - Marathon Industries; 570.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).

4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

## 2.5 SEALANTS

A. Joint Sealants:

B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.6 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.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas Number 10.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).

1. Products: Subject to compliance with requirements, provide one of the following:

a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.9 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. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

2.11 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.

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. C & F Wire.

2.12 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Engineered Brass Company.
   b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
   c. McGuire Manufacturing.
   d. Plumberex.
   e. Truebro; a brand of IPS Corporation.
   f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

## 3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and 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- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [**2 inches (50 mm)**] [**4 inches (100 mm)**] 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 (100 mm) 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.

## 3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

## 3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, 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 (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

## 3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) 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 (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where PVC jackets are indicated, install with 1-inch (25-mm) 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.

3.9 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. 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.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE

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.
4. Vertical stormwater and overflow piping.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:

a. Flexible Elastomeric: 1/2 inch (13 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:

a. Flexible Elastomeric: 3/4 inch (19 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 3/4 inch (13 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

C. Horizontal Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Protective shielding pipe covers.

F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 3/4 inch (19 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) 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. Piping, Concealed:

1. None.

C. Piping, Exposed:

1. PVC: 20 mils (0.5 mm) thick.

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# SECTION 22 11 16 - DOMESTIC WATER 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. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

### 1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

### 1.4 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-G.

C. Plastic piping components shall be marked with "NSF-pw."

### 2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper

1. For above ground piping applications. Refer to Piping Schedule.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

1. For below ground piping applications only. Refer to Piping Schedule.

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. Wrought-Copper, Press Connection Fittings: ASME B16.51, copper and copper alloy press-connect pressure fittings.

F. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

G. 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.

H. Copper Pressure-Seal-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkhart Products Corporation.
b. NIBCO Inc.
c. Viega.

2. Fittings for NPS 4 inches and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

3. Fittings shall be installed per the manufacturer recommendation with the appropriate tools.

## 2.3 CPVC PIPING

A. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

## 2.4 PEX TUBE AND FITTINGS

A. PEX Distribution System: ASTM F 877, SDR 9 tubing.

B. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.

## 2.5 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 A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

## 2.6 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Form: Sheet or tube.

C. Color: Black or natural.

## 2.7 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cascade Waterworks Manufacturing.
b. Dresser, Inc.; Piping Specialties Products.
c. Ford Meter Box Company, Inc. (The).
d. JCM Industries.
e. Romac Industries, Inc.
f. Smith-Blair, Inc.; a Sensus company.
g. Viking Johnson.

D. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Colonial Engineering, Inc.
b. NIBCO Inc.

c. Spears Manufacturing Company.

2. Description:

a. CPVC four-part union.
b. Brass threaded end.
c. Solvent-cement-joint or threaded plastic end.
d. Rubber O-ring.
e. Union nut.

## 2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Jomar International.
e. Matco-Norca.
f. McDonald, A. Y. Mfg. Co.
g. Watts; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn company.

2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
b. Central Plastics Company.
c. Matco-Norca.
d. Watts; a division of Watts Water Technologies, Inc.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elster Perfection Corporation.
b. Grinnell Mechanical Products; Tyco Fire Products LP.
c. Matco-Norca.
d. Precision Plumbing Products, Inc.
e. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Copper Silicone nipple NSF 372 certified and NSF 61 certified for hot and cold domestic water service.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

### 3.2 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 ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

H. Install domestic water piping level and plumb.

I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. 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.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping to permit valve servicing.

N. 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.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install PEX piping with loop at each change of direction of more than 90 degrees.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install pressure gages on suction and discharge piping for each plumbing pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

U. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 221119.

## 3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM 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. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

I. Joints for PEX Piping: Join according to ASTM F 1807.

J. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

## 3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition unions.

## 3.5 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 unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. 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.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
5. NPS 6: 48 inches with 3/4-inch rod.
6. NPS 8: 48 inches with 7/8-inch rod.

G. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

H. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.

I. Install hangers for vertical PEX piping every 48 inches.

J. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

## 3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

## 3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

## 3.9 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.

## 3.10 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.

## 3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. 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.

## 3.12 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. Under-building-slab, domestic water, NPS 3 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

D. Under-building-slab, domestic water, NPS 4 to NPS 8 and larger, shall be the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

E. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints.
4. PEX tube, NPS 1 and smaller; fittings for PEX tube; and crimped joints.

F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

## 3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball valves for piping NPS 2 and smaller. Use gate valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 16

# SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Water pressure-reducing valves.
3. Balancing valves.
4. Temperature-actuated, water mixing valves.
5. Strainers.
6. Outlet boxes.
7. Hose bibbs.
8. Wall hydrants.
9. Post hydrants.
10. Drain valves.
11. Water-hammer arresters.
12. Air vents.
13. Trap-seal guard.
14. Specialty valves.
15. Flexible connectors.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 224716 "Pressure Water Coolers" for water filters for water coolers.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

### 1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61-G and NSF 14. Mark "NSF-pw" on plastic piping components.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Arrowhead Brass Products.
   b. Cash Acme; a division of Reliance Worldwide Corporation.
   c. Conbraco Industries, Inc.
   d. MIFAB, Inc.
   e. Prier Products, Inc.
   f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   g. Woodford Manufacturing Company; a division of WCM Industries, Inc.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Rough bronze.

2.4 WATER PRESSURE-REDUCING VALVES

A. Water-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. CLA-VAL.
   b. Cash (A.W.) Valve Manufacturing Co.

c. Spence Engineering Co. Inc.
d. Watts; a division of Watts Water Technologies, Inc.; Control Valves (Watts ACV).

2. Description: ASSE 1003 certified, direct-operated, diaphragm-type, single-seated, main water-control valve.
3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Bronze body.

a. Pattern: Globe-valve design.
b. Trim: Stainless steel.

5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
6. Provide strainer upstream of water-control valve.
7. Provide full size line bypass with normally closed shut-off valve.

## 2.5 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. Flo Fab Inc.
c. ITT Corporation; Bell & Gossett Div.
d. NIBCO Inc.
e. TAC.
f. TACO Incorporated.
g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
h. Victaulic Company.

2. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

## 2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Primary, Thermostatic, Hi-Lo, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Co.
b. Lawler Manufacturing Company, Inc.
c. Leonard Valve Company.
d. Powers; a division of Watts Water Technologies, Inc.
e. Symmons Industries, Inc.

2. Description: Factory-fabricated, exposed-mounted, thermostatically controlled, water mixing-valve assembly in two-valve parallel arrangement.

3. Large-Flow Parallel: Thermostatic, water mixing valve and downstream-pressure regulator with pressure gages on inlet and outlet.
4. Small-Flow Parallel: Thermostatic, water mixing valve.
5. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
6. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
7. Pressure Rating: 125 psig minimum unless otherwise indicated.
8. Tempered-Water Setting: 120 deg F.
9. Thermostatic Mixing Valve and Water Regulator Finish: Rough bronze.
10. Piping Finish: Copper.

B. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cash Acme; a division of Reliance Worldwide Corporation.
    b. Conbraco Industries, Inc.
    c. Honeywell International Inc.
    d. Lawler Manufacturing Company, Inc.
    e. Leonard Valve Company.
    f. Powers; a division of Watts Water Technologies, Inc.
    g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Standard: ASSE 1070, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.

## 2.7 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Manufacturing CO.
    b. Metraflex Co.
    c. Spirax Sarco
    d. Jay R. Smith
    e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. 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.
4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
5. Screen: Type 304 stainless steel with round perforations unless otherwise indicated.
6. Perforation Size:

    a. Strainers NPS 2 and Smaller: 0.020 inch.
    b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
    c. Strainers NPS 5 and Larger: 0.10 inch.

7. Drain: Factory-installed, hose-end drain valve.

## 2.8 OUTLET BOXES

A. Clothes Washer Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Acorn Engineering Company.
   b. Guy Gray Manufacturing Co., Inc.
   c. IPS Corporation.
   d. Oatey.
   e. Plastic Oddities.
   f. Symmons Industries, Inc.
   g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   h. Whitehall Manufacturing; a div. of Acorn Engineering Company.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
4. 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.
5. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
6. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
7. Inlet Hoses: Two 60-inch- long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
8. Drain Hose: One 48-inch- long, rubber household clothes washer drain hose with hooked end.
9. Water hammer arrestor: Factory installed and serviceable on piping risers.

B. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Acorn Engineering Company.
   b. IPS Corporation.
   c. LSP Products Group, Inc.
   d. Oatey.
   e. Plastic Oddities.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.
6. Water hammer arrestor: Factory installed and serviceable on piping risers.

## 2.9 HOSE BIBBS

A. Hose Bibbs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Chiacgo Faucets.
b. Hammond Valve Corp.
c. Lee Brothers; Div. Phelps Dodge Brass Co.
d. Mansfield Plumbing Products.
e. Nibco Inc.
f. Prier Products, Inc.
g. Tanner Manufacturing Co.
h. Watts Drainage Products.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Service Areas: Chrome or nickel plated.
11. Finish for Finished Rooms: Chrome or nickel plated.
12. Operation for Equipment Rooms: Wheel handle or operating key.
13. Operation for Service Areas: Wheel handle.
14. Operation for Finished Rooms: Operating key.
15. Include operating key with each operating-key hose bibb.
16. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Chiacgo Faucets.
b. Hammond Valve Corp.
c. Lee Brothers; Div. Phelps Dodge Brass Co.
d. Mansfield Plumbing Products.
e. Nibco Inc.
f. Prier Products, Inc.
g. Tanner Manufacturing Co.
h. Watts Drainage Products.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): One with each wall hydrant.

2.11 POST HYDRANTS

A. Nonfreeze, Draining-Type Post Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Chiacgo Faucets.
   b. Hammond Valve Corp.
   c. Lee Brothers; Div. Phelps Dodge Brass Co.
   d. Mansfield Plumbing Products.
   e. Nibco Inc.
   f. Prier Products, Inc.
   g. Tanner Manufacturing Co.
   h. Watts Drainage Products.

2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, exposed-outlet post hydrant.
4. Operation: Loose key.
5. Casing and Operating Rod: Of at least length required for roof thickness.
6. Casing: Bronze with casing guard.
7. Inlet: NPS 3/4.
8. Outlet: Garden-hose thread complying with ASME B1.20.7.
9. Drain: Designed with hole to drain into ground when shut off.
10. Vacuum Breaker:

    a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7 on outlet.

11. Operating Key(s): One with each loose-key-operation post hydrant.

2.12 DRAIN VALVES

A. Hose-End Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a) Hammond Valve Corp.
   b) Lee Brothers; Div. Phelps Dodge Brass Co.
   c) Mansfield Plumbing Products
   d) Prier Brass Mfg. Co.
   e) Tanner Mfg. Co.

2. Standard: MSS SP-110 for standard-port, two-piece ball valves or MSS SP-80 for gate valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: Ball valves for NPS 2 inch and smaller and gate valves for 2-1/2 inch and larger.
5. Body: Copper alloy.
6. Ball: Chrome-plated brass.
7. Seats and Seals: Replaceable.
8. Handle: Vinyl-covered steel.
9. Inlet: Threaded or solder joint.
10. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

11. ASSE 1005 compliance for water heater drain valve.

B. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

## 2.13 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one the following:

a. AMTROL, Inc.
b. Josam Company.
c. MIFAB, Inc.
d. Precision Plumbing Products, Inc.
e. Sioux Chief Manufacturing Company, Inc.
f. Watts Drainage Products.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

## 2.14 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.

## 2.15 TRAP-SEAL GUARD

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Proset Systems, Inc.

B. Material: Smooth, soft, flexible, elastomeric PVC material molded into shape of duck's bill, open on top with curl closure at bottom.

C. Allows wastewater to open and adequately discharge floor drain through its interior.

D. Closes and returns to original molded shape after wastewater discharge is complete.

E. Compliance:

1. ASME A112.6.3.
2. NSF/ANSI 14.
3. CSA B 79.

2.16 SPECIALTY VALVES

A. Comply with requirements for general-duty metal valves in Section 220523 "General-Duty Valves for Plumbing Piping."

B. CPVC Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. IPEX.
c. NIBCO Inc.
d. Spears Manufacturing Company.
e. Thermoplastic Valves Inc.

2. Description:

a. Standard: MSS SP-122.
b. Pressure Rating and Temperature: 125 psig at 73 deg F.
c. Body Material: CPVC.
d. Body Design: Union type.
e. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded.
f. Ball: CPVC; full port.
g. Seals: PTFE or EPDM-rubber O-rings.
h. Handle: Tee shaped.
i.

C. CPVC Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. NIBCO Inc.
b. Spears Manufacturing Company.
c. Thermoplastic Valves Inc.

2. Description:

a. Pressure Rating and Temperature: 125 psig at 73 deg F.
b. Body Material: CPVC.
c. Body Design: Lug or wafer type.
d. Seat: EPDM rubber.
e. Seals: PTFE or EPDM-rubber O-rings.
f. Disc: CPVC.
g. Stem: Stainless steel.
h. Handle: Lever.

D. CPVC Ball Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. IPEX.
c. NIBCO Inc.
d. Spears Manufacturing Company.
e. Thermoplastic Valves Inc.

2. Description:

a. Pressure Rating and Temperature: 125 psig at 73 deg F.
b. Body Material: CPVC.
c. Body Design: Union-type ball check.
d. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded.
e. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, flanged.
f. Ball: CPVC.
g. Seals: EPDM- or FKM-rubber O-rings.

## 2.17 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Flex Pression, Ltd.
4. Flex-Weld Incorporated.
5. Hyspan Precision Products, Inc.
6. Mercer Gasket & Shim, Inc.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. TOZEN Corporation.
10. Unaflex.Universal Metal Hose; a Hyspan company.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 250 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 250 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

B. Install balancing valves in locations where they can easily be adjusted.

C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

D. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

E. 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. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

F. Install water-hammer arresters in water piping according to PDI-WH 201.

G. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

### 3.2 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1.
2. Water pressure-reducing valves.
3. Calibrated balancing valves.
4. Primary, thermostatic, water mixing valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.3 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 22 11 19

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# SECTION 22 13 16 - SANITARY WASTE AND VENT 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. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

### 1.3 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 (30 kPa).

### 1.4 ACTION SUBMITTALS

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

### 1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

### 1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

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.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ANACO-Husky.
b. Dallas Specialty & Mfg. Co.
c. Fernco Inc.
d. Matco-Norca, Inc.
e. MIFAB, Inc.
f. Mission Rubber Company; a division of MCP Industries, Inc.
g. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Dallas Specialty & Mfg. Co.
        2) Fernco Inc.
        3) Mission Rubber Company; a division of MCP Industries, Inc.
        4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

    b. Standard: ASTM C 1173.
    c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. 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.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Capitol Manufacturing Company.
        2) Central Plastics Company.
        3) Hart Industries International, Inc.
        4) Jomar International Ltd.
        5) Matco-Norca, Inc.
        6) McDonald, A. Y. Mfg. Co.
        7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
        8) Wilkins; a Zurn company.

    b. Description:

        1) Standard: ASSE 1079.
        2) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
        3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Capitol Manufacturing Company.
        2) Central Plastics Company.
        3) Matco-Norca, Inc.
        4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
        5) Wilkins; a Zurn company.

b. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Advance Products & Systems, Inc.
2) Calpico, Inc.
3) Central Plastics Company.
4) Pipeline Seal and Insulator, Inc.

b. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig (1035 kPa).
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Elster Perfection.
2) Grinnell Mechanical Products.
3) Matco-Norca, Inc.
4) Precision Plumbing Products, Inc.
5) Victaulic Company.

b. Description:

1) Standard: IAPMO PS 66
2) Electroplated steel nipple.
3) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

## 2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch (0.20-mm) or high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm) minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on 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. 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. 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. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Install aboveground PVC piping according to ASTM D 2665.

O. Install underground PVC piping according to ASTM D 2321.

P. Plumbing Specialties:

1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

## 3.3 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. 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.

C. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

## 3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded, 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 (DN 50) and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

## 3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

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 221319 "Sanitary Waste Piping Specialties."

## 3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. 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 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
6. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

I. Install supports for vertical PVC piping every 48 inches (1200 mm).

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

## 3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage 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 drainage 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 221319 "Sanitary Waste Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

## 3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

## 3.9 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 drainage 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. 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 drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. 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. 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 (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. 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.

## 3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

## 3.11 PIPING SCHEDULE

A. Aboveground and underground soil, waste, and vent piping shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 22 13 16

# SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Roof flashing assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.
7. Oil interceptors.

B. Related Requirements:

1. Section 221423 "Storm Drainage Piping Specialties" for storm drainage piping inside the building, drainage piping specialties, and drains.
2. Section 334100 "Storm Utility Drainage Piping" for storm draining piping and piping specialties outside the building.

### 1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.

2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
    c. Watts Drainage Products Inc.

2. Size: Same as floor drain outlet.
3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float.
5. Inlet: Threaded.
6. Outlet: Threaded or spigot.

C. Horizontal, Plastic Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Canplas LLC.
    b. IPS Corporation.
    c. NDS Inc.
    d. Oatey.
    e. Plastic Oddities; a division of Diverse Corporate Technologies.
    f. Sioux Chief Manufacturing Company, Inc.

2. Size: Same as connected piping.
3. Body: PVC.
4. Cover: Same material as body with threaded access to check valve.
5. Check Valve: Removable swing check.
6. End Connections: Socket type.

## 2.2 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. Oatey.
c. Sioux Chief Manufacturing Company, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.

2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Not 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.
11. Top Loading Classification: Heavy Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; d of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

D. Plastic Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Canplas LLC.
b. IPS Corporation.
c. NDS Inc.
d. Plastic Oddities; a division of Diverse Corporate Technologies.
e. Sioux Chief Manufacturing Company, Inc.

2. Size: Same as connected branch.
3. Body: PVC.
4. Closure Plug: PVC.
5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

## 2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.

2. Standard: ASME A112.6.3 with backwater valve.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Backwater Valve: Drain-outlet type.
10. Coating on Interior and Exposed Exterior Surfaces: Not required.
11. Sediment Bucket: Not required.
12. Top or Strainer Material: Nickel bronze.
13. Top Shape: Round.
14. Top Loading Classification: Heavy Duty.
15. Funnel: Not required.
16. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
17. Trap Material: Cast iron.
18. Trap Pattern: Deep-seal P-trap.
19. Trap Features: Trap-seal primer valve drain connection.

## 2.4 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acorn Engineering Company; Elmdor/Stoneman Div.
    b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm) thick, lead flashing collar and skirt extending at least 6 inches (150 mm) from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

## 2.5 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 (DN 50): 4-inch- (100-mm-) minimum water seal.
    b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

C. 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.

D. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches (51 mm) above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

H. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.

4. Size: Same as connected soil, waste, or vent piping.

## 2.6 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
2. Vent Pipe Flashing: 8 oz./sq. ft. (2.5 kg/sq. m or 0.27-mm thickness).

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## 2.7 OIL INTERCEPTORS

A. Oil Interceptors:

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Park USA
d. Schier Products Company.
e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
f. Watts Drainage Products Inc.

2. Type: Factory-fabricated interceptor for separating and removing light oil from wastewater.
3. Body Material: Cast iron or steel.
4. Interior Lining: Corrosion-resistant enamel.
5. Exterior Coating: Corrosion-resistant enamel.
6. End Connections: Hub.
7. Cleanout: Integral or field installed on outlet.
8. Flow-Control Fitting: Not required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) 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 (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install 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. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

H. Assemble open drain fittings and install with top of hub 2 inches (51 mm) above floor.

I. Install deep-seal traps on floor drains and other waste outlets, if indicated.

J. Install air-gap fittings on indirect-waste piping discharge into sanitary drainage system.

K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

L. Install vent caps on each vent pipe passing through roof.

M. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

N. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

O. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.

P. Install oil interceptors, including trapping, and venting, according to authorities having jurisdiction and with clear space for servicing.

Q. Install wood-blocking reinforcement for wall-mounting-type specialties.

R. 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 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

## 3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

## 3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Oil interceptors.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

## 3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect Oil Interceptors and Solids Interceptors and their installation, including piping and electrical connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

## 3.6 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.

## 3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain Oil Interceptors. Refer to Section 017900 "Demonstration and Training." 01820

END OF SECTION 22 13 19

# SECTION 22 14 29 - SUMP PUMPS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Submersible sump pumps.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

### 1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE SUMP PUMPS

A. Submersible, Fixed-Position, Single-Seal Sump Pumps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Goulds Pumps; ITT Corporation.
   b. Grundfos Pumps Corp.
   c. Liberty Pumps.
   d. Little Giant Pump Co.
   e. Park USA, Inc.
   f. Pentair Pump Group; Hydromatic Pumps.
   g. Pentair Pump Group; Myers.
   h. Stancor, Inc.
   i. Weinman Division; Crane Pumps & Systems.
   j. Zoeller Company.

2. Description: Factory-assembled and -tested sump-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron ASTM A 532/A 532M, abrasion-resistant cast iron and ASTM B 584, cast bronze, semiopen design for clear wastewater handling, and keyed and secured to shaft.
6. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
7. Seal: Mechanical.
8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

   a. Motor Housing Fluid: Oil.

9. Controls:

   a. Enclosure: NEMA 250, Type 4X; wall-mounted.
   b. Switch Type: Mechanical-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
   c. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
   d. Oil alarm.

10. Control-Interface Features:

a. Remote Alarm Contacts: For remote alarm interface.
b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

1) On-off status of pump.
2) Alarm status.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing 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. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Section 312000 "Earth Moving."

3.2 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.3 INSTALLATION

A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Pumps and controls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

## 3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

## 3.7 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

## 3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 22 14 29

# SECTION 22 42 13.13 - 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.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

### 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 six of each type.

## PART 2 - PRODUCTS

### 2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets: Floor mounted, bottom outlet, top spud.

1. Manufacturers: Subject to compliance with requirements, provide products by only the manufacturer listed below, no substitutions are allowed:

   a. American Standard America.
      .

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: Standard and Handicapped/elderly, complying with ICC/ANSI A117.1.
   f. Rim Contour: Elongated.
   g. Water Consumption: 1.28 gal. (4.8 L) per flush.
   h. Spud Size and Location: NPS 1-1/2 (DN 40); top.
   i. Color: White.

3. Bowl-to-Drain Connecting Fitting: ASTM A 1045 or ASME A112.4.3.
4. Flushometer Valve.
5. Toilet Seat: Open, less cover.

## 2.2 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by only the manufacturer listed below, no substitutions are allowed:
   a. Sloan Valve Company.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig (860 kPa).
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: Dual Flush (0.5 gpf and 1.28 gal.)
10. Minimum Inlet: NPS 1 (DN 25).
11. Minimum Outlet: NPS 1-1/4 (DN 32).

## 2.3 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Bemis Manufacturing Company.
   b. Beneke Corp.

c. Olsonite Seat Co.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic, antimicrobial.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Stainless steel.
8. Seat Cover: Not required.
9. Color: White.
10. Bumpers: Replaceable.

## 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. 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 manufacturers provided wall mounted placard indicating dual-flush toilet usage instructions.

C. Install toilet seats on water closets.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. 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 079200 "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 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

## 3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

## 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 42 13.13

# SECTION 22 42 13.16 - COMMERCIAL URINALS

## 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. Urinals.
2. Flushometer valves.

### 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 urinals.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

### 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 six of each type.

## PART 2 - PRODUCTS

### 2.1 WALL-HUNG URINALS

A. Urinals: Wall hung, back outlet, washout, accessible.

1. Manufacturers: Subject to compliance with requirements, provide products by only the manufacturer listed below, no substitutions are allowed:

   a. American Standard America.

2. Fixture:

   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   b. Material: Vitreous china.
   c. Type: Washout with extended shields.
   d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
   e. Water Consumption: Water saving.
   f. Spud Size and Location: NPS 3/4 (DN 20), top.
   g. Outlet Size and Location: NPS 2 (DN 50), back.
   h. Color: White.

3. Flushometer Valve.
4. Waste Fitting:

   a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
   b. Size: NPS 2 (DN 50).

5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.

## 2.2 URINAL FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by only the manufacturer listed below, no substitutions are allowed:
   a. Sloan Valve Company.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig (860 kPa).
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: 0.125 gallon per flush.
10. Minimum Inlet: NPS 3/4 (DN 20).
11. Minimum Outlet: NPS 1-1/4 (DN 32).

# 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 urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

## 3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 13.16

# SECTION 22 42 16.13 - 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.
3. Supply Fittings.
4. Waste Fittings.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

### 1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

### 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. 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 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory: Oval, self-rimming, vitreous china, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by only the manufacturer listed below, no substitutions are allowed:

    a. American Standard America.

2. Fixture:

    a. Standard: ASME A112.19.2/CSA B45.1.
    b. Type: Self-rimming for above-counter mounting.
    c. Nominal Size: Oval.
    d. Faucet-Hole Punching: Three holes, 4-inch (102-mm) centers.
    e. Faucet-Hole Location: Top.
    f. Color: White.
    g. Mounting Material: Sealant.

3. Faucet.

### 2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory: Wheelchair, vitreous china, wall mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by only the manufacturer listed below, no substitutions are allowed:

2. Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed. Retain option and delete insert note if manufacturer's name and model number are indicated on Drawings.

    a. American Standard America.

3. Fixture:

    a. Standard: ASME A112.19.2/CSA B45.1.
    b. Type: Slab or wheelchair.
    c. Nominal Size: Rectangular, 27 by 20 inches (686 by 508 mm).
    d. Faucet-Hole Punching: Three holes, 4 inch centers.
    e. Faucet-Hole Location: Top.
    f. Color: White.
    g. Mounting: For concealed-arm carrier.

4. Faucet.
5. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier with rectangular, steel uprights.

## 2.3 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61-G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Manual-type, single-control mixing, commercial, solid-brass valve.

1. Manufacturers: Subject to compliance with requirements, provide products by only the manufacturer listed below, no substitutions are allowed:

   a. Delta Faucet Company.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Type: Single hole.
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): Single lever or ADA Compliant Wrist blade, 4 inches (102 mm).
10. Spout: Rigid type.
11. Spout Outlet: Aerator.
12. Operation: Compression, manual.

## 2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61-G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.

F. Risers:

1. NPS 3/8 (DN 10).
2. ASME A112.18.6, braided 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 (DN 32) offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4 (DN 40 by DN 32).
2. Material: Two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall and cleanout plug; and brass wall flange.
   a. Chrome-plated if exposed.

## 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. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

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 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "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 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

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 42 16.13

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# SECTION 22 42 16.16 - COMMERCIAL SINKS

## 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. Service basins.
2. Kitchen sinks.
3. Sink faucets.
4. Supply fittings.
5. Waste fittings.
6. Dishwasher air-gap fittings.
7. Disposers.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics and furnished specialties and accessories.

### 1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

### 1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

A. Service Basins: Plastic, floor mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Plumbing, L.L.C.
b. Ferguson Enterprises, Inc.; ProFlo Brand.
c. Florestone Products Co., Inc.
d. Mustee, E. L., & Sons, Inc.
e. Swan Corporation (The).

2. Fixture:

a. Standard: IAPMO/ANSI Z124.6.
b. Material: Cast polymer.
c. Minimum Size: 24 by 24 by 8 inches.
d. Tiling Flange: On two sides.
e. Rim Guard: On all top surfaces.
f. Color: Not applicable.
g. Drain: Grid with NPS 2 min. (DN 80) outlet.
h. Wall covers: Required
i. Mop Hanger: Required
j. Pail Hook: Required
k. Flexible Hose: Required

3. Mounting: On floor and flush to wall.
4. Faucet: Wall mounted.

2.2 KITCHEN SINKS

A. Utility Sinks: Stainless steel, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Tabco.
b. Elkay Manufacturing Co.
c. Griffin Products, Inc.
d. Just Manufacturing.

2. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Type: Ledge back.
c. Number of Compartments: One or Two.
d. Metal Thickness: 0.050 inch (1.3 mm).
e. Compartment:
1) Drain: NPS 1-1/2 (DN 40) tailpiece with stopper.
2) Drain Location: Near back of compartment.

3. Faucet(s):

   a. Number Required: One.
   b. Mounting: On ledge.

4. Mounting: On counter with sealant.

## 2.3 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61-G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets: Manual type, single-control mixing valve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Standard America.
   b. Chicago Faucets.
   c. Delta Faucet Company.
   d. Just Manufacturing.
   e. Speakman Company.
   f. T & S Brass and Bronze Works, Inc.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Type: Centerset or Widespread.
5. Body Material: Commercial, solid brass.
6. Finish: Chrome plated.
7. Maximum Flow Rate: 1.8 gpm (8.3 L/min.).
8. Handle(s): Lever, Cross, or Four-arm Wrist blade, 4 inches (102 mm).
9. Mounting Type: Deck, exposed or Back/wall, exposed.
10. Spout Type: Rigid, solid brass with wall brace or Swing, shaped tube.
11. Vacuum Breaker: Required for hose outlet.
12. Spout Outlet: Laminar flow or Hose thread according to ASME B1.20.7.

## 2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61-G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.

F. Risers:

1. NPS 3/8 (DN 10)
2. ASME A112.18.6, braided stainless-steel flexible hose.

## 2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 (DN 40) offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 (DN 40).
2. Material: Two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall; and chrome-plated brass wall flange.
   a. Chrome-plated if exposed.

## 2.6 DISHWASHER AIR-GAP FITTINGS

A. Dishwasher Air-Gap Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. B & K Industries, Inc.
   b. Brass Craft Manufacturing; a subsidiary of Masco Corporation.
   c. BrassTech Inc.
   d. Dearborn Brass.
   e. Geberit US.
   f. Sioux Chief Manufacturing Company, Inc.
   g. Watts Brass & Tubular; a division of Watts Water Technologies, Inc.

2. Standard: ASSE 1021.
3. Description: Device designed to prevent backflow of contaminated liquid into domestic dishwashers.
4. Material: Plastic body with chrome-plated-brass cover.
5. Hose Connections: 5/8-inch- (16-mm-) ID inlet and 7/8-inch- (22-mm-) ID outlet.
6. Capacity: At least 5 gpm (0.32 L/s); at inlet pressure of at least 5 psig (35 kPa) and at temperature of at least 140 deg F (60 deg C).
7. Mounting: Deck.
8. Hoses: Rubber and suitable for temperature of at least 140 deg F (60 deg C).

   a. Inlet Hose: 5/8 inch (16 mm) ID and 48 inches (1219 mm) long.
   b. Outlet Hose: 7/8 inch (22 mm) ID and 48 inches (1219 mm) long.

## 2.7 DISPOSERS

A. Disposers: Continuous-feed household, food waste.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Standard America.
   b. Franke Consumer Products, Inc.

c. InSinkErator.
d. KitchenAid.
e. Maytag.

2. Standards: ASSE 1008 and UL 430, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. General: Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 (DN 40) outlet; quick-mounting, stainless-steel sink flange; antisplash guard; and combination cover/stopper.
4. Model: Sound-insulated chamber and stainless-steel outer shell.
5. Motor: 115-V ac, 1725 rpm, 3/4 hp with overload protection.

## 2.8 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

# 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 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 according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Install disposer in outlet of each sink indicated to have a disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

H. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install in sink deck. Connect inlet hose to dishwasher and outlet hose to disposer.

I. 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 079200 "Joint Sealants."

J. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

## 3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

## 3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

## 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 42 16.16

# SECTION 22 42 23 - 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. Showers.
2. Shower faucets.
3. Grout.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers and basins.
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 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

### 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. 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.

### 1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures of unit shell.
    b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 SHOWERS

A. Individual FRP Showers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or an approved equal product by one of the following:

    a. Aqua Bath Co.
    b. Praxis Industries, LLC.; Aquarius Bathware.
    c. Sterling; a Kohler company.

2. General: Shower enclosure with faucet, receptor, and appurtenances.
3. Size: 36 by 36 by 78 inches.
4. Standard: ANSI Z124.1.2.
5. Type: One-piece unit.
6. Faucet: Refer to faucets article.
7. Color: White.
8. Bathing Surface: Slip resistant according to ASTM F 462.
9. Outlet: Center grid drain with NPS 2 (DN 50) outlet.

B. Transfer showers: Accessible FRP with seat and grab bars.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Aqua Bath Co.
    b. Praxis Industries, LLC.; Aquarius Bathware.
    c. Sterling; a Kohler company.

2. Standards: ANSI Z124.1.2 and ICC/ANSI A117.1 for transfer shower compartments.
3. General: Shower enclosure with faucet, receptor, and appurtenances.
4. Style: ADA compliant.
5. Nominal Size: 39-1/2 by 37 by 82 inches.
6. Surround: One piece.
7. Bathing Surface: Slip resistant according to ASTM F 462.
8. Color: White.
9. Outlet: Center grid drain with NPS 2 (DN 50) outlet.
10. Accessibility Options: Stainless steel grab bars and phenolic fold-up seat.
11. Grab Bars: ASTM F 446.
12. Faucet: Refer to faucets article.

C. Roll-in showers: Accessible FRP with seat and grab bars.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Aqua Bath Co.
    b. Praxis Industries, LLC.; Aquarius Bathware.
    c. Sterling; a Kohler company.

2. Standards: ANSI Z124.1.2 and ICC/ANSI A117.1 for roll-in shower compartments.
3. General: Shower enclosure with faucet, receptor, and appurtenances.
4. Style: ADA compliant for handicapped/wheelchair persons.
5. Nominal Size: 33 by 62 by 78-3/4 inches.
6. Surround: One piece.
7. Bathing Surface: Slip resistant according to ASTM F 462.
8. Color: White.
9. Outlet: Center grid drain with NPS 2 (DN 50) outlet.
10. Accessibility Options: Stainless steel grab bars and phenolic fold-up seat.
11. Grab Bars: ASTM F 446.
12. Faucet: Refer to faucets article.

## 2.2 SHOWER FAUCETS

A. NSF Standard: Comply with NSF 61-G, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.

B. Shower Faucets: Single handle, pressure balance, mixing valve.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated by only the manufacturer listed below, no substitutions are allowed:
    a. Delta Faucet Co.

2. Fixture:

    a. Standard: ASME A112.18.1/CSA B125.1 and ASSE 1016.
    b. General: Include hot- and cold-water indicators; check stops; and fixed shower head, arm, and flange and hand head complying with ASSE 1014 with arm, flange, hose, and bracket for accessible showers. Coordinate faucet inlets with supplies.
    c. Body Material: Solid brass.
    d. Finish: Polished chrome plate.
    e. Maximum Flow Rate: 2.5 gpm (9.5 L/min.) unless otherwise indicated.
    f. Mounting: Exposed.
    g. Operation: Compression, manual.
    h. Antiscald Device: Integral with mixing valve.
    i. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

3. Supply Connections: NPS 1/2 (DN 15).
4. Shower Head:

    a. Type: Ball joint and head integral with mounting flange or hand-held, slide-bar mounted.
    b. Shower Head Material: Metallic with chrome-plated finish.
    c. Spray Pattern: Fixed.
    d. Integral Volume Control: Not required.
    e. Shower-Arm, Flow-Control Fitting: 1.5 gpm (5.7 L/min.).

5. Additional requirements:
   a. Provide built in shut off stops, washerless, mixer type shower and tub valve with metal blade handle.

   b. Valve shall open to cold water first and then through warm (mix) to hot.

   c. Faucet shall have all operating parts separately replaceable from outside the wall, rotating cylinder type operating mechanisms, equipped with replaceable nonmetallic seats contained in stainless steel lined sockets.

   d. Valve shall be equipped with pressure balance spool and sleeve device of Type 302 stainless steel which will maintain a preset high temperature limit; check stop (with an adjustable stop to prevent the possibility of the valve being turned to full hot water).

   e. Provide with hand held shower head with swivel fitting, 60” flexible stainless steel hose, in-line vacuum breaker, and 24” chrome plated shower head slide guide set at 42” and 66” above the shower unit floor.

## 2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

# 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. Install shower components according to manufacturers' 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 "General-Duty 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. Set showers in leveling bed of cement grout.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. 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 to produce proper flow.

## 3.5 CLEANING AND PROTECTION

A. After completing installation of showers and basins, 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 plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 23

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# SECTION 22 47 16 - 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 pressure water coolers and related components.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

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: Include diagrams for power, signal, and control wiring.

### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

### 1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: Equal to 10 percent of quantity installed for each type and size indicated, but no fewer than 1 of each.

## PART 2 - PRODUCTS

### 2.1 PRESSURE WATER COOLERS

A. Pressure Water Coolers: Wall mounted, wheelchair accessible, stainless steel, with bottle filler.

1. Manufacturers: Subject to compliance with requirements, provide products by only the manufacturer listed below, no substitutions are allowed:

a. Elkay Manufacturing Co.

2. Cabinet: Bi-level with two attached cabinets, all stainless steel construction and finish.
3. Bubbler: One, 0.3 GPM, with adjustable stream regulator, located on each cabinet deck.
4. Control: Push bar using less than five lbs. of force.
5. Bottle filler with push button operation.
6. Drain: Grid with NPS 1-1/4 (DN 32) tailpiece.
7. Supply: NPS 3/8 (DN 10) with shutoff valve.
8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 (DN 32) brass P-trap.
9. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
10. Cooling System: Electric, with hermetically sealed compressor, R-134, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

    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.

11. Capacities and Characteristics:

    a. Cooled Water: 8 gph (0.0053 L/s).
    b. Ambient-Air Temperature: 90 deg F (32 deg C).
    c. Inlet-Water Temperature: 80 deg F (27 deg C).
    d. Cooled-Water Temperature: 50 deg F (10 deg C).

12. Support: ASME A112.6.1M, Type I water-cooler carrier equal to Watts CA-421.

## 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 water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. 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 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. Install ball, gate, or globe shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

## 3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

## 3.5 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 47 16

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# SECTION 23 00 10 - GENERAL REQUIREMENTS FOR HVAC SYSTEMS

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. The General Requirements for Mechanical Work are intended to be complementary to the General Requirements of the Construction Contract.

B. Work Included: Provide complete mechanical systems where shown on the drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to the following summary of work:

1. Test & Balance: will be provided by the Contractor and paid by the Contractor in accordance with spec 230593. Contractor responsibilities to support the Test & Balance effort are contained in spec 230593.

2. Provide a VAV AHU and VAV boxes with hot water reheat on the first floor.

3. Provide a complete hydronic heating system including condensing boilers, lead/lag pumps, and domestic hot water generators.

4. Provide roof-mounted Energy Recovery Ventilators (ERV) with chilled and heating coils and heat wheels for the dormitory units including ancillary spaces on levels two through five. ERV's shall supply 70°F.

5. Provide four-pipe vertical stack fan coil units for the dormitory units including ancillary spaces on levels two through five.

6. Route condensate drains to rainwater harvesting tanks provided by Landscape Architect.

7. Building Management System (BMS) shall be MSU standard type and connect to the University's campus BMS. All power to VAV Boxes on first floor shall be 24V from HVAC Control Panels.

8. Other items and services required to complete the systems.

### 1.2 QUALITY ASSURANCE AND APPLICABLE STANDARDS

A. Use adequate numbers of skilled workers that are thoroughly trained and experienced in the necessary crafts and are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Architect/Engineer/Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. Codes: Perform all work in accordance with the latest edition of the following codes:

1. State and city building, fire, plumbing, and mechanical codes.

2. National Electrical Code (NEC)

3. National Fire Protection Association (NFPA)

4. American with Disabilities Act (ADA)

5. Texas Accessibility Standards (TAS)

6. All authorities having jurisdiction.

D. Where conflicts occur between drawings, specifications, and code requirements, the most stringent requirement shall take precedence.

E. Standards: The specifications and standards of the following organizations are by reference made a part of these specifications. All work, unless otherwise indicated, shall comply with the requirements and recommendations wherever applicable:

1. American National Standards Institute (ANSI)

2. Air Conditioning and Refrigeration Institute (ARI)

3. American Gas Association (AGA)

4. American Society for Testing and Materials (ASTM)

5. American Society of Plumbing Engineers (ASPE)

6. American Society of Mechanical Engineers (ASME)

7. American Society of Refrigeration, Heating and Air Conditioning Engineers (ASHRAE)

8. Electrical Testing Laboratories (ETL)

9. National Bureau of Standards (NBS)

10. National Electrical Manufacturer's Association (NEMA)

11. National Fire Protection Association (NFPA)

12. Sheet Metal and Air Conditioning National Association (SMACNA)

13. Underwriters Laboratories, Inc. (UL)

F. Electrical Characteristics for Equipment: Equipment of differing electrical characteristics may be furnished provided such equipment is proposed on the “Alternate Manufacturer Evaluation Form”, subsequently approved, and connecting electrical services, circuit breakers, and conduit sizes appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

G. When requested, provide the Owner’s Authorized Representative with manufacturer’s certificate that materials meet or exceed minimum requirements as specified.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. The requirements and recommendations of the latest edition of the Occupational Safety and

Health Administration (OSHA) Act are by reference made a part of these specifications. All work shall comply with the requirements and recommendations wherever applicable.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. All Other Sections of Divisions 21, 22, 23 and 26 (as applicable).

B. All other divisions of the contract documents. Refer to each division's specifications and drawings for all requirements

1.5 SUBMITTALS

A. Comply with pertinent provisions of Division 01.

B. Provide Specifications per Division 01 for all submitted alternate equipment.

Product Data: Submit the following:

1. Materials list of items proposed to be provided under Division 23.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in the following paragraph.

3. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Architect/Engineer/Owner can **easily** determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Organize in a clear and concise format. All substitutions shall be approved in writing by Architect/Engineer. The Architect/Engineer’s decision shall be final.

4. Allow a minimum of ten (10) working days for the review of submittals and each re-submittal.

5. Compliance with the Contract documents shall be the sole responsibility of the Contractor. Items on equipment that are were not accepted by the Architect/Engineer in writing as an approved equal shall be replaced or revised to comply with the contract documents at the Contractor's expense.

6. Manufacturer's recommended installation procedures which, when reviewed by the Architect/Engineer, shall become the basis for accepting or rejecting actual installation procedures used on the work.

7. Sign the submittal as an indication of compliance with the contract documents. Any deviations from the contract documents shall be indicated on the submittal prior to signing. Any deviations not indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor’s expense.

C. Submittals required of materials and equipment under this section include the following:

1. Piping and Accessories Materials

a. Clearly marked up manufacturer's data showing compliance with the specifications for:

1) Piping material proposed for each system.

2) Valves, cocks, and specialties.

3) Test and measuring devices.

4) Heating, chilled, and condenser water specialties.

5) Flexible connectors for piping.

6) Flanges.

b. l/8" scale (minimum) chilled water, condenser water, heating hot water and refrigerant piping shop drawings showing coordinated piping routing and arrangements with all equipment, accessories and system expansion and contraction compensation methods.

2. Vibration Isolation and Sound Control Materials

a. Submit shop drawings showing the structural design and details of inertia bases, steel beam bases, and other custom-fabricated work not covered by manufacturer's submitted data.

b. Furnish layouts of templates to be furnished to fabricators of equipment bases, foundations, and other support systems, as needed for coordination of vibration isolation units with other work.

c. Submit shop drawings indicating the scope of vibration isolation work, locations of units and flexible connections. Include support isolation points for piping, air handling units, inertia bases, etc.

d. Include schedule of isolation units, showing size or manufacturer's part number, the weight supported and resulting deflection of each unit.

e. For spring isolation units, show wire size, spring diameter, free height, solid-compression height, operating height, fatigue characteristics and ratio of horizontal to vertical stiffness.

f. For spring-and-pad type isolation units, show the basis of spring rate selection for the range of loading weights.

3. Identification Materials

a. Clearly marked-up product literature or samples showing compliance with specified materials for:

1) Valve tagging.

2) Pipe marking.

3) Equipment marking.

4. Insulation

a. Manufacturer's certified data on thermal performance.

b. Details, when required, of methods to be used in providing for unusual piping expansion and contraction.

c. Manufacturer's product data and application information on heat tracing system including all electrical requirements.

d. Manufacturer's data on any alternate insulation material of reduced thickness, including pre-insulated pipe.

e. Manufacturer's data on all jacketing materials, sealants and fasteners.

5. Pumps

a. Provide factory certified performance curve clearly marked with the operating point of each pump.

b. Provide manufacturer's data on all panels, accessories, and specified factory options.

c. Provide all electrical characteristics.

6. Heating

a. Provide clearly marked-up manufacturer's data showing compliance with scheduled values and specifications for:

1) Boilers.

2) Flue pipe and accessories.

3) Domestic hot water generators.

b. Provide all electrical characteristics.

7. Air Handling

a. Provide clearly marked-up manufacturer's data showing compliance with scheduled values and specifications for:

1) AHU, factory assembled.

3) Chilled and hot water coils.

4) Fan coil units.

5) Ventilation fans.

6) Filters.

7) Energy recovery ventilators.

8) Wall louvers.

b. Provide all electrical characteristics.

8. Air Distribution Materials

a. Provide clearly marked-up manufacturer's data showing compliance with scheduled values and specifications for:

1) Air devices.

2) 1/4" scale ductwork shop drawings for all systems showing equipment locations, detailed data such as bottom of duct elevations, airstream sizes, all duct accessories, and duct construction details showing compliance with SMACNA requirements for the specified duct pressure of each system.

3) Fire dampers, fire and smoke dampers.

4) Air terminals.

9. Controls and Instrumentation

a. Provide detailed shop drawings showing all components, wiring, tubing, and accessories.

b. Provide comprehensive sequence of operation description of each control system.

c. Provide clearly marked-up manufacturer's data showing compliance with the specifications for all products proposed.

d. Provide all electrical characteristics of components.

10. Building Management System

a. Provide detailed schematic drawings showing all components and their arrangement and their relation to the control system.

b. Provide manufacturer's data showing compliance with specified control components and functions specified.

c. Provide all electrical power source requirements.

d. BMS shall be MSU standard type and connect to the University’s campus BMS.

11. Testing and Balancing

a. Brief description of test and balance contractor experience.

b. Certificate of Qualification from NEBB or AABC.

c. Biographical information of the Registered Professional Engineer and certified Test and Balance Supervisor proposed to manage the project.

d. List of instruments to be used with latest date of calibration test for each.

e. Test and balance reports.

12. Variable Frequency Drives/Speed Controllers (VFD)

a. Provide clearly marked-up manufacturer's data showing compliance with scheduled values and specifications.

b. Provide electrical characteristic.

13. Record Documents: Reference the requirements detailed in this section.

14. Operation and Maintenance Data: Reference the requirements detailed in this section.

D Resubmittals of rejected submittals shall be limited to one (1) in number. Costs for processing subsequent resubmittals in excess of the first resubmittal, resulting from the Contractor's disregard of Architect/Engineer's primary submittal rejection comments, shall be borne by the Contractor. Costs shall be based on Architect/Engineer's hourly rates as published in their current professional fee schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost plus fifteen percent (15%).

E. Shop Drawings: Upon written request of the Contractor, the Architect/Engineer will provide directly to the Contractor electronic backgrounds of drawings required to produce shop drawings. The requirements to secure electronic files for shop drawing purposes are the same as for record drawing purposes. See 230010, Paragraph 1.15.H.2.

1.6 SUBSTITUTIONS

A. The use of manufacturers' names and catalog numbers followed by the phrase "or equal" is generally used to establish a standard of quality and utility for the specified items and to provide a dimensional reference for construction documents that are drawn to scale.

B. Submittals for "equal" items shall, where applicable, include the following data that are not necessarily required for specified items:

1. Performance characteristics.

2. Materials.

3. Finish.

4. Certification of conformance with specified codes and standards.

5. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in Paragraph 6 below.

6. Identify the difference between the specified item or function and the proposed. Explain

with enough detail so that the Architect/ Engineer/Owner can **easily** determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Include shop drawings for all piping and ductwork equipment per Paragraph 1.5 Submittals. Organize in a clear and concise format.

C. Submittals of "equal" components or systems may be rejected if:

1. The material or equipment would necessitate the alteration of any portion of the mechanical, electrical, architectural or structural design.

2. Dimensions vary from the specified material or equipment in such a manner that accessibility or clearances are impaired or the work of other trades is adversely affected.

D. Proposed substitutions for materials or equipment must be submitted ten (10) days **prior** to final bid date for consideration as approved equals. Otherwise, such substitutions will not be permitted. **Only** Prime Bidders are allowed to make proposals for substitutions. Manufacturers, distributors, and sub-contractors shall **not** make proposals to the Architect/Engineer for substitutions.

E. No substitution shall be made unless authorized in writing by the Architect/Engineer. Should a substitution be accepted, and should the substitute material prove defective or otherwise unsatisfactory for the service intended, and within the guarantee period, replace this material or equipment with material or equipment specified, at no additional cost to the Architect/Engineer/Owner, and to the satisfaction of the Architect/Engineer.

F. Contractors submitting bids on substitute materials and equipment must also provide a written performance guarantee certifying that the substitute materials and equipment will produce the specified effects and meet the approval of the Architect/Engineer.

1.7 ORDINANCES, PERMITS, METERS, UTILITIES, AND ROYALTIES

A. Procure all permits and licenses necessary for completion of this project and pay all lawful fees required and necessary pursuant in obtaining said permits and licenses. All required certificates of approvals and inspections by local governing and regulating authorities shall be obtained and paid for by the Contractor.

B. Pay all fees required for the connection of water, gas, and sewer to utility mains, and any meter fees if required.

C. Pay any royalty payments required or fees for the use of patented equipment or systems. Defend all law suits or claims for infringement of any patent rights and shall hold the Owner and Architect/Engineer harmless from loss as a result of said suits or claims.

1.8 COMPATIBILITY OF EQUIPMENT

A. Assume full responsibility for satisfactory operation of all component parts of the mechanical systems to assure compatibility of all equipment and performance of the integrated systems in accordance with the requirements of the specifications. Should the Contractor consider any part of the specifications or drawings as rendering his acceptance of such responsibility impossible, prohibitive, or restrictive, he shall notify the Architect/Engineer before submitting his bid, and the bid shall be accompanied by a written statement of any objections or exceptions to the specifications and drawings.

1.9 EXISTING UTILITIES AND TEMPORARY SERVICES FOR CONSTRUCTION

A. Verify the location and capacity of existing utility services pertaining to work of Division 23. Relocate existing utilities unearthed by excavation as directed by the utility service companies affected.

B. Temporary Services for Construction

1. Provide temporary services in strict accordance with the provisions of these specifications.

1.10 EXCAVATION AND BACKFILLING

A. Perform all excavation and backfilling necessary for the installation of the work. This shall include shoring and pumping in ditches to keep them in dry condition until the work has been installed. Properly perform all shoring required to protect the excavation and to safeguard employees.

B. Perform excavation and backfilling in strict accordance with the provisions of these specifications including trench safety requirements.

C. Make all excavations to the proper depth, with allowances made for floor slabs, forms, beams, etc. Properly compact ground under piping before installing piping.

D. Provide backfilling with selected soil, free from rocks and debris and pneumatically tamp with 6-inch layers to secure a field density ratio of 95 percent as defined by ASTM Designation D698-57T (Proctor Soil Compaction Test).

E. Remove from the site, excavated materials not suitable and not used in the backfill.

F. Field check and verify the locations of all underground utilities. Avoid disturbing these as far as possible. In the event existing utilities are damaged, repair them at no cost to the Architect/Engineer/Owner.

G. In a lime-stabilized area, fully restore the lime stabilization after the excavation is complete.

H. Replace concrete, curbs, paving, and other surface improvements cut during excavation to their original condition.

1.11 JOBSITE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Include required work to correct conditions detrimental to the timely and proper completion of all Division 23 Work. Do not proceed until unsatisfactory conditions are corrected.

1.12 PREPARATION AND COORDINATION

A. Perform coordination work in strict accordance with provisions of these specifications and the following:

1. Coordinate as necessary with other trades to assure proper and adequate interface with all work.

2. Where ducts, pipes and other mechanical items are shown in conflict with locations of structural members and other equipment, include labor and materials required for

extensions, offsets and supports to clear the encroachment.

3. Although such work is not specifically indicated, provide all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation.

4. Coordinate accepted equipment changes from those scheduled or specified with other trades affected. Additional compensation to other trades for equipment changes is the responsibility of the Contractor making the change.

B. Mechanical Drawings are diagrammatic. Follow the drawings as closely as actual construction and work of other trades will permit. Duct and piping arrangement have been designed for maximum economy consistent with good practice and other considerations. Install the systems arranged as shown on the drawings, except as otherwise approved in advance by the Architect/Engineer.

C. Data indicated on the Drawings and in these Specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels, and other conditions will be governed by actual construction and the Drawings and Specifications should be used only for guidance in such regard.

D. Where items such as diffusers, thermostats, switches, and control panels are not specifically located on the Drawings, provide an RFI to the Architect/Engineer, and locate as determined in the field by the Architect/Engineer. Where such items are installed without such specific direction, relocate as directed by the Architect/Engineer, and at no additional cost to the Architect/Engineer/Owner.

E. Verify all dimensions and distances. No additional compensation will be allowed because of differences between work shown on the Drawings and actual dimensions and distances at the jobsite.

1.13 CONSTRUCTION REQUIREMENTS

A. The drawings show the arrangements of work. Should project conditions necessitate rearrangement, or if the materials or equipment can be installed to a better advantage in a different manner, before proceeding with the work, prepare and submit five copies of Drawings of the proposed arrangement for the Architect/Engineer's review. Allow a minimum of ten (10) working days for review.

B. Should the Contractor propose to install equipment requiring space conditions other than those shown, or rearrange the equipment, he shall assume responsibility for the rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such changes shall be accompanied by contractor-generated detailed shop drawings of the space in question. Identify monetary credits proposed or other benefits of the change. Allow a minimum of ten (10) working days for review.

C. Properly locate and size all slots, holes, and openings in the building structure pertaining to the work and for the correct location of pipe sleeves, duct sleeves, fire dampers, etc., as applicable to the work.

1.14 CUTTING AND PATCHING

A. Perform cutting and patching associated with the work in strict accordance with the provisions of Division 1 of these Specifications and the following:

1. Coordinate work to minimize cutting and patching work.

2. Request for Architect/Engineer's Consent

   a. Prior to cutting or coring of the building structure, submit a written request to the Architect/Engineer for permission to proceed with cutting. Include x-rays of any floor area where cutting or coring is proposed.

   b. Contractor is cautioned that concrete floor may contain steel tendons, pipes, and electrical/telecom conduits, all of which can not be cut or damaged.

3. Perform Architect/Engineer-approved cutting and demolition by methods that will prevent damage to other portions of the work and provide proper surfaces to receive installation of new work and repair.

4. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.

5. Provide all core drilling of holes. Where sleeves and blockouts are required, they shall be cut or provided at locations required. On completion of this work or as work progresses, make all repairs and do all patching required as a result of work under this Contract. All patching shall be performed in a manner that will restore the surrounding work to its original condition to the satisfaction of the Architect/Engineer.

6. Assume responsibility for the proper size of all sleeves and blockouts in the building structure pertaining to the work and for providing the correct location of pipe sleeves and blockouts.

7. Where openings are cut through masonry walls, provide lintels or structural supports to protect the remaining masonry. Provide adequate support during the cutting operation to prevent any damage to the affected masonry.

1.15 PROJECT RECORD DOCUMENTS

A. Provide the record documents associated with the work of Division 23 in strict accordance with the provisions of these specifications.

B. Throughout progress of the Division 23 Work, maintain an accurate record of changes in the Contract Documents that apply to work of Division 23. Changes shall include all addendums issued during bidding. Maintain an accurate record of the location of mechanical service lines and outlets and all outside utilities.

C. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Architect/Engineer. Submit in writing at the pre-construction conference the name and credentials of the person responsible for record mark-ups and maintenance.

D. Accuracy of Records

1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of drawings and other documents where such entry is required to show the change properly. Match the symbology and format of the base documents.

2. Accuracy of records shall be such that a future verification of items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

E. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of all recorded data to the final Project Record Documents.

F. Making Entries on Drawings

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.

2. Date all entries.

3. Call attention to the entry by a "cloud" drawn around the area or areas affected.

4. In the event of overlapping changes, use different colors for the overlapping changes.

5. Make entries within 24 hours after receipt of information that the change has occurred.

6. Maintain the base drawing format and use the same symbology.

7. Convert field mark-ups to finished CADD record drawings when required in this section.

G. Conversion of Schematic Layouts

1. In some cases on the drawings, arrangements of ductwork and piping and similar items are shown schematically and are not intended to portray precise physical layout. Determine final physical arrangement subject to the Architect/Engineer's approval. However, design of future modifications of the facility may require accurate information as to the final physical layout of items that are shown only schematically on the drawings.

2. Show on the job set of record drawings, by dimension accurate to within one inch, the centerline of each run of items such as all sleeves and piping, etc., below grade, in walls, or in the concrete slab. A surface mounted device indicates the exact location:

a. Clearly identify the item by accurate note such as "Chilled Water" and the like.

b. Show, by symbol or note, the vertical location of the item "under slab," "in ceiling plenum," "exposed," and the like.

c. Make all identification sufficiently descriptive that it may be related reliably to the specifications.

H. Final Project Record Documents

1. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.

2. Provide CADD electronic files in ".dwg" Format using AutoCAD Release 2012 software (minimum). Upon written request and completion of a release form, the Engineer will provide AutoCAD Release 2012 electronic files of base Contract Drawings in dwg format on compact disc. The Engineer will also provide a list of drawing layers and names that shall be maintained.

3. Provide completed record drawings on CD and one Mylar film reproducible of each drawing.

4. Refer to Section 017700 for additional requirements.

1.16 OPERATION AND MAINTENANCE DATA

A. Well before substantial completion, submit two copies of a preliminary draft of the proposed manual(s) to the Architect/Engineer for review and comments. Allow a minimum of ten (10) working days for review.

B. Submit specified number copies of the approved manual to the Architect/Engineer prior to indoctrination of operation and maintenance personnel.

C. Prepare in accordance with the following standards:

**Format:**

Size: 8½" x 11"

Paper: White bond, at least 20 lb. weight

Text: Neatly written or printed

Drawings: 11" in height preferable; bind in with text; foldouts acceptable; larger drawings are acceptable but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.

**Flysheets:** Separate each section of the Manual with neatly prepared flysheets briefly describing contents of the ensuing section; flysheets may be in color.

**Binding:** Use heavy-duty plastic or fiberboard covers with binding mechanism concealed inside the manual; 3-ring binders will be acceptable; all binding is subject to the Architect/ Engineer's approval.

**Measurements:** Provide all measurements in U.S. standard units such as feet-and-inches, lbs, and cfm. Where items may be expected to be measured within ten years in accordance with metric formulae, provide additional measurements in the "International System of Units" (SI).

D. Provide front and back covers for each manual, using durable material approved by the Architect/Engineer, and clearly identified on or through the cover with at least the following information:

1. OPERATING AND MAINTENANCE INSTRUCTIONS

a. Name and Address of Work

b. Name of Contractor

c. General subject of this manual

d. Space for approval signature of the Architect/Engineer and approval date

E. Contents: Include at least the following:

1. Neatly typewritten index near the front of the manual, giving immediate information as to location within the manual of all emergency information regarding the installation.

2. Complete instructions regarding operation and maintenance of all equipment provided including lubrication, disassembly, and reassembly.

3. Complete nomenclature of all parts of all equipment.

4. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.

5. Copy of all guarantees and warranties issued.

6. Manufacturer's bulletins, drawings, and descriptive data, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.

7. Such other data as required in other sections of these specifications.

1.17 EQUIPMENT FOUNDATIONS

A. Provide equipment foundations associated with the work in accordance with the provisions of these specifications.

B. Provide concrete bases for all pad or floor mounted equipment. Bases shall be four inches (4") high above finished floors or grades (unless otherwise noted) and shall protrude two inches (2") beyond all sides of equipment and shall have exposed chamfered edges. Construct bases from ready-mixed hardrock concrete, ASTM C94, reinforced with #3 rebar, ASTM A615, Grade 40, at 18" on center each way.

C. Field verify exact location of outdoor pad mounted equipment with the Architect/ Engineer. Supply necessary fill and grade site to provide natural drainage away from equipment.

1.18 PAINTING

A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be damaged in transit or during the installation, it shall be finished to match appearance of original finish. All work shall be subject to approval by Architect/Engineer.

1.19 TESTING AND INSPECTION

A. Provide personnel and equipment, make required tests, and secure required approvals from the Architect/Engineer and governmental agencies having jurisdiction.

B. Make written notice to the Architect/Engineer, adequately in advance, of each of the following stages of construction:

1. When all rough-in is complete, but not covered;

2. As specified in all Division 23 sections.

3. At the completion of the work of Division 23.

C. When material or workmanship is found to not comply with the specified requirements, remove the noncomplying items from the job site and replace them with items complying with the specified requirements at no additional cost to the Architect/Engineer/Owner. This shall be performed within 3 days after receipt of written notice of noncompliance.

1.20 WARRANTY

A. Warranty all equipment and workmanship for a period of one year after date of substantial completion and replace or repair any faulty equipment or installation at no cost to the Architect/Engineer/Owner for such service during this period, all in accordance with requirements of Division 01.

B. Provide full material warranty on all compressors for a period of five years after date of substantial completion.

C. This warranty shall not void specific warranties issued by manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the Owner by law.

D. Warranties shall be in writing in a form satisfactory to the Owner, and shall be delivered to the Owner before final payment is made.

1.21 PROJECT COMPLETION

A. Upon completion of the work of Division 23, thoroughly clean all exposed portions of the mechanical installation, removing all traces of soil, labels, grease, oil, and other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned.

END OF SECTION 23 00 10

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SECTION 23 01 12 - INTERDISCIPLINARY COORDINATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Refer to Section 230010 – GENERAL REQUIREMENTS FOR HVAC SYSTEMS

1.2 SUMMARY

A. This Section describes the coordination between the Mechanical, Plumbing, Fire Protection, and Electrical portions of the work.

B. This Section is also included under Divisions 21, 22, 26, and 28 portions of the Specifications.

1.3 WORK INCLUDED

A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. The schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:

| | ITEM | FURNISHED UNDER DIVISION | INSTALLED UNDER DIVISION | WIRED AND CONNECTED UNDER DIVISION |
|---|---|---|---|---|
| 1. | Equipment Motors | Note 9 | Note 9 | 26 |
| 2. | Magnetic motor Starters | | | |
| | a. Automatically controlled, with or without HOA switches. | 26 | 26 | Notes 1,3,5 |
| | b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment. | Note 9 | Note 9 | Notes 1,3,5 |
| | c. Manually controlled | 26 | 26 | Notes 1,3,5 |
| | d. Manually controlled and furnished as part of the factory wired equipment. | Note 9 | Note 9 | Notes 1,3,5 |
| | e. Furnished in motor Control Centers. | 26 | 26 | Notes 1,3,5 |
| 3. | Variable Speed (Frequency) AC Drives. | 23 | 26 | Notes 1,4,5 |
| 4. | Line voltage thermostats, time clocks, etc., not connected to control panel systems. | 23 | 23 | 26 |
| 5. | Electric thermostats, time clocks, remote bulb | 23 | 23 | 23 |

| | | | | |
|---|---|---|---|---|
| | thermostats, motorized valves, float controls, etc. which are an integral part of directly attached to ducts, pipes, etc. | | | |
| 6. | Temperature control panels and time switches mounted on temperature control panels. | 23 | 23 | Note 1 |
| 7. | Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc. | 23 | 23 | Note 1 |
| 8. | Alarm bells furnished with equipment installed by Division 23. | 23 | 23 | 23 |
| 9. | Wiring to obtain power for control circuits, including circuit breaker. | 26 | 26 | 26 |
| 10. | Low voltage controls | 23 | 23 | 23 |
| 11. | Fire protection system (sprinkler) controls. | 21 | 21 | Note 8 |
| 12. | Smoke detectors installed on mechanical units and in ductwork. | 26 | 23 | Note 2 |
| 13. | All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with VAC equipment to provide operation and control of HVAC equipment. | 23 | 23 | Note 1 |
| 14. | Smoke dampers, and combination fire/smoke dampers. | 23 | 23 | Note 7 |
| 15. | Boiler and water heater controls, boiler burner controls panels. | 23 | 23 | Note 1 |
| 16. | Pushbutton stations, pilot lights. | 26 | 26 | 26 |
| 17. | Heat Tape. | Note 9 | Note 9 | 26 |
| 18. | Disconnect switches, manual operating switches furnished as a part from equipment. | Note 9 | Note 9 | Notes 1, 5 |
| 19. | Disconnect switches, manual operating switches furnished separate from equipment. | 26 | 26 | 26 |
| 20. | Multispeed switches. | 23 | 23 | 26 |
| 21. | Thermal overloads. | 23 | 23 | 23 |
| 22. | Control relays, transformers. | 23 | 23 | 23 |
| 23. | Refrigeration cycle, cooling tower and controls. | 23 | 23 | 23 |
| 24. | Tamper switches for fire protection (sprinkler) system. | 21 | 21 | 26 |

| | | | | |
|---|---|---|---|---|
| 25. | Flow and/or pressure switches for fire protection (sprinkler) system. | 21 | 21 | 26 |
| 26. | Fire and jockey pump controllers and automatic transfer switch. | 21 | 21 | Note 6 |
| 27. | Alarm bells or horns for fire protection system. | 21 | 21 | 26 |
| 28. | Generator (underground) fuel tank. | 22 | 22 | - |
| 29. | Generator (underground) fuel tank level indicator. | 22 | 22 | 26 |
| 30. | Generator fuel piping from tank to generator. | 22 | 22 | - |
| 31. | Underground fuel tank leak detection and monitoring system. | 22 | 22 | 22 |

Notes

(1) Power wiring as defined in Section 260519 of the specifications shall be provided under Division 26. Control wiring shall be provided under Division 23.

(2) Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 28 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 and 26 specifications and the Drawings for more specific requirements.

(3) For requirements for magnetic motor Starters, refer to Section 262913 – ENCLOSED CONTROLLERS.

(4) For requirements for Variable Speed (Frequency) AC drives, refer to Section 230514 –VARIABLE-FREQUENCY DRIVES.

(5) Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.

(6) Power wiring from energy source to controllers and automatic transfer switch shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 23 and conform to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.

(7) Division 28 will provide power to all smoke and combination fire/smoke dampers, including control wiring for all such dampers using area smoke detectors.

(8) Wiring for sprinkler system controls to be provided by Division 21. Wiring from devices to Fire Alarm System to be provided by Division 28.

(9) All components provided with packaged equipment shall be furnished and installed by the Contractor providing the equipment.

B. CONNECTIONS: Make all connections to controls that are directly attached to duct, piping, and mechanical equipment with flexible connections.

C. PRECEDENCE

1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.

2. Precedence for pipe, conduit and duct systems shall be as follows:
   a. Building lines
   b. Structural members
   c. Soil and drain piping
   d. Vent piping
   e. Steam piping
   f. Condensate piping
   g. Refrigerant piping
   h. Electrical bus duct
   i. Supply ductwork
   j. Return ductwork
   k. Exhaust ductwork
   l. Chilled water and heating water piping
   m. Automatic Fire Protection Sprinkler Piping
   n. Natural gas piping
   o. Domestic hot and cold water piping
   p. Electrical conduit

D. FINAL INSPECTION AND REPORT

1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical, Fire Alarm, and Temperature Control Contractors, representatives of mechanical and electrical equipment manufacturers whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of the meeting, listing those in attendance, and the companies that they represent shall be filed with the Owner, Architect, and Engineer of Record.

# SECTION 23 01 30.51 - HVAC AIR-DISTRIBUTION SYSTEM CLEANING

## 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 cleaning HVAC air-distribution equipment, ducts, plenums, and system components.

B. The procedures contain herein shall be utilized if the air handling equipment is activated prior to the cleaning of the building and if MSU deems that the ductwork, AHU, FCU's, or ERVs are dirty.

### 1.3 DEFINITIONS

A. ASCS: Air systems cleaning specialist.

B. NADCA: National Air Duct Cleaners Association.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For an ASCS.

B. Strategies and procedures plan.

C. Cleanliness verification report.

### 1.5 QUALITY ASSURANCE

A. ASCS Qualifications: A certified member of NADCA

1. Certification: Employ an ASCS certified by NADCA on a full-time basis.
2. Supervisor Qualifications: Certified as an ASCS by NADCA.

B. Cleaning Conference: Conduct conference at Project site.

1. Review methods and procedures related to HVAC air-distribution system cleaning including, but not limited to, review of the cleaning strategies and procedures plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine HVAC air-distribution equipment, ducts, plenums, and system components to determine appropriate methods, tools, and equipment required for performance of the Work.

B. Perform "Project Evaluation and Recommendation" according to NADCA ACR 2006.

C. Prepare written report listing conditions detrimental to performance of the Work.

D. Proceed with work only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare a written plan that includes strategies and step-by-step procedures. At a minimum, include the following:

1. Supervisor contact information.
2. Work schedule including location, times, and impact on occupied areas.
3. Methods and materials planned for each HVAC component type.
4. Required support from other trades.
5. Equipment and material storage requirements.
6. Exhaust equipment setup locations.

B. Use the existing service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and for inspection.

C. Comply with NADCA ACR 2006, "Guidelines for Constructing Service Openings in HVAC Systems" Section.

3.3 CLEANING

A. Comply with NADCA ACR 2006.

B. Remove visible surface contaminants and deposits from within the HVAC system.

C. Systems and Components to Be Cleaned:

1. Air devices for supply and return air.
2. Air-terminal units.
3. Ductwork:

    a. Supply-air ducts, including turning vanes and reheat coils, to the air-handling unit.
    b. Return-air ducts to the air-handling unit.
    c. Exhaust-air ducts.

4. Air-Handling Units:

a. Interior surfaces of the unit casing.
b. Coil surfaces compartment.
c. Condensate drain pans.
d. Fans, fan blades, and fan housings.

5. Filters and filter housings.

D. Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process.

E. Particulate Collection:

1. For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
2. HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger shall be used where the particulate collection equipment is exhausting inside the building,

F. Control odors and mist vapors during the cleaning and restoration process.

G. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.

H. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.

I. Clean all air-distribution devices, registers, grilles, and diffusers.

J. Clean visible surface contamination deposits according to NADCA ACR 2006 and the following:

1. Clean air-handling units, airstream surfaces, components, condensate collectors, and drains.
2. Ensure that a suitable operative drainage system is in place prior to beginning wash-down procedures.
3. Clean evaporator coils, reheat coils, and other airstream components.

K. Duct Systems:

1. Create service openings in the HVAC system as necessary to accommodate cleaning.
2. Mechanically clean duct systems specified to remove all visible contaminants so that the systems are capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2006).

L. Debris removed from the HVAC system shall be disposed of according to applicable Federal, state, and local requirements.

M. Mechanical Cleaning Methodology:

1. Source-Removal Cleaning Methods: The HVAC system shall be cleaned using source-removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.

a. Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.

b. Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials such as duct and plenum liners.

2. Cleaning Mineral-Fiber Insulation Components:

a. Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR 2006.
b. Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2006).
c. Fibrous materials that become wet shall be discarded and replaced.

N. Coil Cleaning:

1. Measure static-pressure differential across each coil.
2. See NADCA ACR 2006, "Coil Surface Cleaning" Section. Type 1, or Type 1 and Type 2, cleaning methods shall be used to render the coil visibly clean and capable of passing Coil Cleaning Verification (see applicable NADCA ACR 2006).
3. Coil drain pans shall be subject to NADCA ACR 2006, "Non-Porous Surfaces Cleaning Verification." Ensure that condensate drain pans are operational.
4. Electric-resistance coils shall be de-energized, locked out, and tagged before cleaning.
5. Cleaning methods shall not cause any appreciable damage to, cause displacement of, inhibit heat transfer, or cause erosion of the coil surface or fins, and shall comply with coil manufacturer's written recommendations when available.
6. Rinse thoroughly with clean water to remove any latent residues.

O. Antimicrobial Agents and Coatings:

1. Apply antimicrobial agents and coatings if active fungal growth is reasonably suspected or where unacceptable levels of fungal contamination have been verified. Apply antimicrobial agents and coatings according to manufacturer's written recommendations and EPA registration listing after the removal of surface deposits and debris.
2. When used, antimicrobial treatments and coatings shall be applied after the system is rendered clean.
3. Apply antimicrobial agents and coatings directly onto surfaces of interior ductwork.
4. Sanitizing agent products shall be registered by the EPA as specifically intended for use in HVAC systems and ductwork.

## 3.4 CLEANLINESS VERIFICATION

A. Verify cleanliness according to NADCA ACR 2006, "Verification of HVAC System Cleanliness" Section.

B. Verify HVAC system cleanliness after mechanical cleaning and before applying any treatment or introducing any treatment-related substance to the HVAC system, including biocidal agents and coatings.

C. Perform visual inspection for cleanliness. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.

D. Additional Verification:

1. Perform surface comparison testing or NADCA vacuum test.
2. Conduct NADCA vacuum gravimetric test analysis for nonporous surfaces.

E. Verification of Coil Cleaning:

1. Measure static-pressure differential across each coil.
2. Coil will be considered clean if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection.

F. Prepare a written cleanliness verification report. At a minimum, include the following:

1. Written documentation of the success of the cleaning.
2. Site inspection reports, initialed by supervisor, including notation on areas of inspection, as verified through visual inspection.
3. Surface comparison test results if required.
4. Gravimetric analysis (nonporous surfaces only).
5. System areas found to be damaged.

G. Photographic Documentation: Comply with requirements in Section 013233 "Photographic Documentation."

## 3.5 RESTORATION

A. Restore and repair HVAC air-distribution equipment, ducts, plenums, and components according to NADCA ACR 2006, "Restoration and Repair of Mechanical Systems" Section.

B. Restore service openings capable of future reopening. Comply with requirements in Section 233113 "Metal Ducts." Include location of service openings in Project closeout report.

C. Replace fibrous-glass materials that cannot be restored by cleaning or resurfacing. Comply with requirements in Section 233113 "Metal Ducts".

D. Replace damaged insulation according to Section 230713 "Duct Insulation."

E. Ensure that closures do not hinder or alter airflow.

F. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.

END OF SECTION 23 01 30.51

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# SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of 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 ac 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.

### 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.

### 2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F or Class B

J. Code Letter Designation:

1. Motors 15HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes324Tand larger; rolled steel for motor frame sizes smaller than 324T.

## 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

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:

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. Energy- and 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.

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 05 13

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# SECTION 23 05 48.13 - 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. Elastomeric isolation mounts.
3. Open-spring isolators.
4. Housed-spring isolators.
5. Pipe-riser resilient supports.
6. Resilient pipe guides.
7. Elastomeric hangers.
8. Spring hangers.
9. Vibration isolation equipment bases.

### 1.3 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.

1.4 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.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Ribbed pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.

a. Surface Pattern: Ribbed pattern.
b. Infused nonwoven cotton or synthetic fibers.

2.2 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Ace Mountings Co., Inc.

b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

## 2.3 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

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. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

## 2.4 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.

f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

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. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

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. Top housing with attachment and leveling bolt**.**

## 2.5 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- thick neoprene <.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psigon isolation material providing equal isolation in all directions.

## 2.6 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch- thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

## 2.7 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods: .
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawingsor comparable product by one of the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Mountings & Controls, Inc.

2. 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.

3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

## 2.8 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression: .
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Kinetics Noise Control, Inc.
d. Mason Industries, Inc.
e. Vibration Eliminator Co., Inc.
f. Vibration Isolation.
g. Vibration Mountings & Controls, Inc.

2. 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.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

## 2.9 VIBRATION ISOLATION EQUIPMENT BASES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. California Dynamics Corporation.
2. Kinetics Noise Control.
3. Mason Industries, Inc.
4. Vibration Eliminator Co., Inc.
5. Vibration Isolation.
6. Vibration Mountings & Controls, Inc.

B. 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 A 36/A 36M. 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.

C. 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.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases 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.

D. Concrete Inertia Base: Factory-fabricated or field-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

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.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases 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.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

## 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 033000 "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.

3.3 VIBRATION ISOLATION EQUIPMENT BASES 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 033000 "Cast-in-Place Concrete."

END OF SECTION 23 05 48.13

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# SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Valve tags.
6. Warning tags.

### 1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

### 1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. 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), plus 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. 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: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 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, semi-rigid plastic formed to fully cover 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, 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 1-1/2 inches high.

2.4 DUCT 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: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, 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.
2. Lettering Size: At least 1-1/2 inches high.

2.5 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.

3. Identification Paint: Exterior, acrylic enamelin colors according to ASME A13.1 unless otherwise indicated.

2.6 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: Aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link 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.

2.7 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

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. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting**"**

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Piping identification standard is ANSI A13.1 “Scheme for Identification of Piping Systems”.
2. Label all HVAC piping, including, but not limited to:
   a. Chilled-Water Piping
   b. Heating Water Piping
   c. Condensate Piping
   d. Gas Piping

## 3.4 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For supply ducts.
2. Orange: For return-air supply ducts.
3. Yellow: For outside-air ducts.
4. Green: For exhaust-air and relief-air ducts.
5. ASME A13.1 Colors and Designs: For all other ductwork.

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

## 3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Chilled Water: 2 inches, round.
b. Hot Water: 2 inches, round.
c. Gas: 2 inches, round.
d. Condensate: 2 inches, round.

2. Valve-Tag Color:

a. Chilled Water: Natural.
b. Hot Water: Natural.
c. Gas: Natural.
d. Condensate: Natural.

3. Letter Color:

a. Chilled Water: Black.
b. Hot Water: Black.
c. Gas: Black.
d. Condensate: Black.

## 3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

# SECTION 23 07 13 - DUCT INSULATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.

B. Related Sections:

1. Section 230716 "HVAC Equipment Insulation."
2. Section 230719 "HVAC Piping Insulation."
3. Section 233113 "Metal Ducts" for duct liners.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

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 insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule" 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 I. FSK Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite XG.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.

e. Owens Corning; SOFTR All-Service Duct Wrap.

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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.Eagle Bridges - Marathon Industries; 225.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
b. Eagle Bridges - Marathon Industries; 501.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.

d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

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 Flashing Sealants:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
c. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.5 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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas No. 5.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
b. Vimasco Corporation; Elastafab 894.

2.7 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

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. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.8 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

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.

2.9 SECUREMENTS

A. Bands:

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. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inchwide with wing seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, wide with wing seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

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) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

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) AGM Industries, Inc.; CHP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      1) GEMCO; Nylon Hangers.
      2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

   b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
   c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
      2) GEMCO; Peel & Press.
      3) Midwest Fasteners, Inc.; Self Stick.

   b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      1) AGM Industries, Inc.; RC-150.
      2) GEMCO; R-150.
      3) Midwest Fasteners, Inc.; WA-150.
      4) Nelson Stud Welding; Speed Clips.

   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

    a. Manufacturers: 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) GEMCO.
        2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy

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. C & F Wire.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. 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 4 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

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.

## 3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at 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.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping” for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

## 3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 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.

## 3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. 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.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

## 3.7 DUCT INSULATION SCHEDULE

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed exhaust located in unconditioned space.
6. Indoor, exposed exhaust 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.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed and exposed, round and rectangular supply-, return-, exhaust-, and outside-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: Minimum R-6 installed (2 inches thick and 3-lb/cu. ft. nominal density).
   a. Return and exhaust ductwork shall only be insulated within 10 feet of leaving the building or connection to equipment.

END OF SECTION 23 07 13

# SECTION 23 07 16 - HVAC EQUIPMENT INSULATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes insulating the following HVAC equipment that is not factory insulated:

1. Heating, hot-water pumps.
2. Air separators.

B. Related Sections:

1. Section 230713 "Duct Insulation."
2. Section 230719 "HVAC Piping Insulation."

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. 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 removable insulation at equipment connections.
4. Detail application of field-applied jackets.
5. Detail application at linkages of control devices.
6. Detail field application for each equipment type.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

### 1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Breeching Insulation Schedule" and "Equipment 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. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Sheet and K-FLEX LS.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. Provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; CertaPro Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. CertainTeed Corp.; CrimpWrap.
    b. Johns Manville; MicroFlex.
    c. Knauf Insulation; Pipe and Tank Insulation.
    d. Manson Insulation Inc.; AK Flex.
    e. Owens Corning; Fiberglas Pipe and Tank Insulation.

## 2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Aeroflex USA, Inc.; Aeroseal.
    b. Armacell LLC; Armaflex 520 Adhesive.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    b. - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. FSK Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation; 739, Dow Silicone.
b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
b. - Marathon Industries; 501.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

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 Jacket Flashing Sealants:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. PVC Jacket Flashing Sealants:

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.5 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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering equipment.

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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas No. 5.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for equipment.

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. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
    b. Vimasco Corporation; Elastafab 894.

## 2.7 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

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. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

## 2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto Corporation; LoSmoke.
    d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White
4. Factory-fabricated tank heads and tank side panels.

## 2.9 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

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. ABI, Ideal Tape Division; 491 AWF FSK.
    b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    c. Compac Corporation; 110 and 111.
    d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

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.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

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. ABI, Ideal Tape Division; 370 White PVC tape.
    b. Compac Corporation; 130.
    c. Venture Tape; 1506 CW NS.

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.

## 2.10 SECUREMENTS

A. Bands:

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. ITW Insulation Systems; Gerrard Strapping and Seals.
    b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inchwide with wing seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

    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) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

   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) AGM Industries, Inc.; CHP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

   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) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.

   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

   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) GEMCO; Nylon Hangers.
      2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

   b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
   c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

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) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers, Series.
2) GEMCO; Peel & Press.
3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers: 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) GEMCO.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: 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. C & F Wire.

## 2.11 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.

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.

O. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

## 3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100] percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

C. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from galvanized steel, at least 0.040 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: **E**ngage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections: Inspect field-insulated equipment, 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 for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate equipment that is not factory insulated.

C. Heating-hot-water pump insulation shall be one of the following:

1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

2. Flexible Elastomeric: 1-1/2 inch (25 mm) thick.

D. Heating-hot-water air-separator insulation shall be one of the following:

1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

2. Mineral Fiber Pipe and Tank: 2 inch thick.

3.8 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. Equipment:
1. PVC: 20 mils thick.

END OF SECTION 23 07 16

# SECTION 23 31 13 - METAL DUCTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

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 PERFORMANCE REQUIREMENTS

A. 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"

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

2. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

## 1.5 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. 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. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. 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. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support

intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. 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.

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.

## 2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. CertainTeed Corporation; Insulation Group.
    b. Johns Manville.
    c. Knauf Insulation.
    d. Owens Corning.
2. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

    a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

      a. Aeroflex USA Inc.
      b. Armacell LLC.
      c. Rubatex International, LLC

   2. 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.
   3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

      a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Insulation Pins and Washers:

   1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
   2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

   1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
   2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
   3. Butt transverse joints without gaps, and coat joint with adhesive.
   4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
   5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
   6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
   7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

      a. Fan discharges.
      b. Intervals of lined duct preceding unlined duct.
      c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

   8. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. 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 for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

## 2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. 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.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. 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.

K. 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.

L. 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.

## 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 C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

## 3.4 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.

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 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 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. Give seven days' advance notice for testing.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Supply Ducts:

1. Ducts Connected to Fan Coil Units and Terminal Units:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Constant-Volume Air-Handling Units:

a. Pressure Class: Positive 3-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

3. Ducts Connected to Variable-Air-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: 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: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

B. Return Ducts:

1. Ducts Connected to Fan Coil Units and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 4-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: 3.

D. 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 2-inch wg.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

F. Liner:
1. Supply Fan Plenums: Fibrous glass, Type II, 1 inch thick.
2. Return- and Exhaust-Fan Plenums: , thick.
3. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.

G. Double-Wall Duct Interstitial Insulation:

1. Supply Air Ducts: 1 inch thick.
2. Return Air Ducts: 1 inch thick.
3. Exhaust Air Ducts: 1 inch thick.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

    a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

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) 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.

END OF SECTION 23 31 13

# SECTION 23 33 00 - AIR DUCT ACCESSORIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Backdraft relief dampers.
2. Manual volume dampers.
3. Fire dampers.
4. Turning vanes.
5. Remote damper operators.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Flexible ducts.
9. Duct accessory hardware.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. 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.

### 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.

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.
2. Exposed-Surface Finish: Mill phosphatized.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

C. 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 DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Greenheck Fan Corporation.
2. Lloyd Industries, Inc.
3. Nailor Industries Inc.
4. Pottorff.
5. Ruskin Company.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 1000 fpm.

D. Maximum System Pressure: 1-inch wg.

E. Frame: Hat-shaped, 0.05-inch- thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.

F. Blades: Multiple single-piece blades, end pivoted, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Neoprene, mechanically locked.

I. Blade Axles:

1. Material: Aluminum.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Aluminum.

K. Return Spring: Adjustable tension.

L. Bearings: 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. Screen Mounting: Rear mounted.
4. Screen Material: Aluminum.
5. Screen Type: Bird.
6. 90-degree stops.

## 2.4 MANUAL VOLUME DAMPERS

A. Low-Leakage, Steel, Manual Volume Dampers:

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. Greenheck Fan Corp.
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 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.
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, roll-formed steel, 0.064 inch thick.

7. Blade Axles: Galvanized steel.
8. Bearings:

    a. Molded synthetic.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Neoprene.
10. Jamb Seals: Cambered aluminum.
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. 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.

C. 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 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

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 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: 0.05 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, 212 deg F rated, fusible links.

## 2.6 TURNING VANES

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. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. METALAIRE, Inc.
5. SEMCO Incorporated.
6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. 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.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. 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."

E. Vane Construction:
1. Single wall on ductwork 46 inches and smaller.
2. Double wall on ductwork 48 inches and larger.

## 2.7 REMOTE DAMPER OPERATORS

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. Pottorff.
2. Ventfabrics, Inc.
3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed.

F. Wall-Box Cover-Plate Material: Stainless steel.

## 2.8 DUCT-MOUNTED ACCESS DOORS

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. Ductmate Industries, Inc.
2. Flexmaster U.S.A., Inc.
3. Greenheck Fan Corporation.
4. McGill AirFlow LLC.
5. Nailor Industries Inc.
6. Pottorff.
7. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. 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.
d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.

4. Doors close when pressures are within set-point range.
5. Hinge: Continuous piano.
6. Latches: Cam.
7. Seal: Neoprene or foam rubber.
8. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

## 2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. Ventfabrics, Inc.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

## 2.10 FLEXIBLE DUCTS

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. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

C. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

## 2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel.

C. 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.

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. Upstream from turning vanes.
2. Downstream from manual volume dampers, backdraft dampers, and equipment.
3. 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.
4. Control devices requiring inspection.
5. 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 flexible ducts to metal ducts with adhesive plus sheet metal screws.

O. 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 33 00

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# SECTION 23 34 23 - HVAC POWER VENTILATORS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Ceiling-mounted ventilators.
2. In-line centrifugal fans.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

### 1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control reports.

### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Standards: Power ventilators shall comply with UL 705.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED VENTILATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Broan-NuTone LLC.
2. Greenheck Fan Corporation.
3. Panasonic.
4. PennBarry.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:
1. Hooded wall cap with birdscreen and backdraft damper.
2. Round duct connector.

2.2 IN-LINE CENTRIFUGAL FANS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Acme Engineering & Manufacturing Corporation.
2. Greenheck Fan Corporation.
3. PennBarry.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

E. Accessories:
1. Electronically commutated motor with transformer that converts AC power to DC power.
2. Factory mounted potentiometer on motor.
3. Dry contacts for input from BMS.

## 2.3 CONTROLS

A. Refer to Section 230900 "Instrumentation and Control for HVAC."

B. Refer to Section 230993 “Sequence of Operations for HVAC Controls.”

C. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display power ventilator status and alarms.

1. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the power ventilator from an operator workstation.

## 2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: 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. Enclosure Type: Totally enclosed, fan cooled.

## 2.5 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Equipment Mounting:
1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548.13 "Vibration Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system.
5. Adjust damper linkages for proper damper operation.
6. Verify lubrication for bearings and other moving parts.

7. Verify that manual and automatic volume control in connected ductwork systems are in fully open position.
8. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
9. Shut unit down and reconnect automatic temperature-control operators.
10. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

## 3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

C. Replace fan and motor pulleys as required to achieve design airflow.

D. Lubricate bearings.

END OF SECTION 23 34 23

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# SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Square ceiling diffusers.
2. Linear slot diffusers.
3. Adjustable registers.
4. Fixed face grilles.

B. Related Sections:

1. Section 233300 "Air Duct Accessories" for fire dampers and volume-control dampers not integral to diffusers, registers, and grilles.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

## PART 2 - PRODUCTS

### 2.1 CEILING DIFFUSERS

A. Square Ceiling Diffusers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Hart & Cooley Inc.
b. Krueger.
c. METALAIRE, Inc.
d. Nailor Industries Inc.
e. Price Industries.
f. Titus.
g. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Maximum Noise Criteria: 25.
4. Material: Aluminum.
5. Finish: Baked enamel, white.
6. Face Size: 12 x 12 or 24 by 24 inches.
7. Face Style: Plaque.
8. Mounting: T-bar.
9. Pattern: Fixed.
10. Dampers: Butterfly, if installed in non-accessible ceiling.
11. Accessories:

    a. Plaster ring, if installed in non-accessible ceiling.
    b. Insulated back panel.

## 2.2 CEILING LINEAR SLOT OUTLETS

A. Linear Slot Diffuser:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Hart & Cooley Inc.
    b. Krueger.
    c. METALAIRE, Inc.
    d. Nailor Industries Inc.
    e. Price Industries.
    f. Titus.
    g. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Maximum Noise Criteria: 25.
4. Material - Shell: Aluminum, noninsulated.
5. Material - Pattern Controller and Tees: Aluminum.
6. Finish - Face and Shell: Baked enamel, black.
7. Finish - Tees: Baked enamel, white.
8. Mounting: Concealed.
9. Provide number of slots as shown on plans.

## 2.3 REGISTERS AND GRILLES

A. Adjustable Register:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Hart & Cooley Inc.
    b. Krueger.
    c. METALAIRE, Inc.
    d. Nailor Industries Inc.
    e. Price Industries.
    f. Titus.
    g. Tuttle & Bailey.

2. Maximum Noise Criteria: 25.
3. Material: Aluminum.

4. Finish: Baked enamel, white.
5. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.
6. Core Construction: Integral.
7. Frame: 1-1/4 inches wide.
8. Mounting: Surface.
9. Accessories:
   a. Plaster ring, if installed in non-accessible ceiling
   b. Damper Type: Adjustable opposed blade.

B. Fixed Face Grille:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Hart & Cooley Inc.
   b. Krueger.
   c. METALAIRE, Inc.
   d. Nailor Industries Inc.
   e. Price Industries.
   f. Titus.
   g. Tuttle & Bailey.

2. Maximum Noise Criteria: 25.
3. Material: Aluminum.
4. Finish: Baked enamel, white.
5. Core Construction: Integral.
6. Frame: 1-1/4 inches wide.
7. Mounting: Surface.
8. Accessories:
   a. Plaster ring, if installed in non-accessible ceiling
   b. Damper Type: Adjustable opposed blade

## 2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air

volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. Insulate all diffuser, register, and grille back panels and ductwork connections. Refer to Specification “230713 Duct Insulation.”

## 3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

# SECTION 23 81 26 - SPLIT-SYSTEM AIR-CONDITIONERS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

### 1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

### 1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

### 1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

## 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year(s) from date of Substantial Completion.
c. For Labor: One year(s) from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Carrier Corporation; a unit of United Technologies Corp.
2. Lennox Industries, Inc.; Lennox International.
3. LG Electronics, USA
4. Mitsubishi Electric & Electronics USA, Inc.
5. Trane.

## 2.2 INDOOR UNITS 5 TONS OR LESS

A. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
3. Fan: Direct drive, centrifugal.
4. Fan Motors:

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
c. Enclosure Type: Totally enclosed, fan cooled.
d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
f. Mount unit-mounted disconnect switches on exterior of unit.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

6. Condensate Drain Pans:

   a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

      1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
      2) Depth: A minimum of 1 inch deep.

   b. Single-wall, galvanized-steel sheet.
   c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

      1) Minimum Connection Size: NPS 1.

   d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

7. Air Filtration Section:

   a. General Requirements for Air Filtration Section:

      1) Comply with NFPA 90A.
      2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
      3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

   b. Disposable Panel Filters:

      1) Factory-fabricated, viscous-coated, flat-panel type.
      2) Thickness: 1 inch.
      3) Dust-Holding Capacity:.
      4) Initial Resistance:.
      5) Recommended Final Resistance:
      6) Arrestance according to ASHRAE 52.1: 80.
      7) Merv according to ASHRAE 52.2: 5.
      8) Media: Interlaced glass fibers sprayed with nonflammable adhesive.
      9) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

## 2.3 OUTDOOR UNITS ( 5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

   a. Compressor Type: Scroll.

b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
c. Refrigerant Charge: R-410A.
d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.

3. Fan: Aluminum-propeller type, directly connected to motor.
4. Motor: Permanently lubricated, with integral thermal-overload protection.
5. Low Ambient Kit: Permits operation down to 45 deg F.
6. Mounting Base: Polyethylene.

## 2.4 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified inSection 077200 "Roof Accessories."Section 07720 "Roof Accessories."Anchor units to supports with removable, cadmium-plated fasteners.

D. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

## 3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Remote, Water-Cooled Condenser Connections: Comply with requirements specified in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Connect hydronic piping to supply and return connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply ducts to split-system air-

conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

END OF SECTION 238126

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# SECTION 23 81 46 VARIABLE REFRIGERANT FLOW HEAT RECOVERY AIR CONDITIONING SYSTEM

## PART 1 - PRODUCT DESCRIPTION

### 1.1 DESCRIPTION

A. Variable Refrigerant Flow (VRF) HVAC system shall be a variable capacity, direct expansion (DX) heat recovery engineered system. The outdoor unit shall consist of one or more frames) connected through common refrigerant piping and control communication wiring. Each system shall have single or multiple, inverter compressor(s). Each system shall be connected to multiple indoor units (ducted, non-ducted or mixed combinations) through a common refrigerant piping network and integrated system controls and communication network. Each indoor unit shall be controlled individually or as a group. Additionally, heat recovery systems shall be capable of simultaneous heating and cooling of individual zone(s).

B. System Performance Documentation: The VRF manufacturer shall provide published outdoor unit performance data in table format which states the products heating and cooling capacity expressed in British thermal units per hour (BtuH) and power consumption expressed in kilowatts (kW) at a minimum of 8 possible combinations of allowed conditions between 50% and 130% connection ratio. Possible combinations of allowed condition variables include Combination Ratios expressed as a percentage value, Outdoor Ambient Temperature expressed in degrees Fahrenheit (°F), and indoor unit Entering Air wet and dry bulb temperature expressed in degrees Fahrenheit (°F). Any product whose system design and engineering manuals or guides where published data tables are expressed in units other than these specified will not be accepted.

C. Any product whose published documentation requires the design engineer to apply a correction factor derived from a published curve or tabular data for combination ratio, outdoor ambient temperature, and/or entering air temperature against rated conditions to obtain performance at any possible combination of allowed conditions will not be accepted.

D. Submittals: a complete submittal package shall be complied and 10 copies shall be forwarded to the general contractor who shall supply the architect with the submittals for dissemination to all parties. The submittal shall be a collection of documents that represent the technical aspects of each product or collection of products to be used on the project. All performance submissions shall be calculated at the design temperatures, nominal performance data shall not be allowed. The submission and approval of said submittals does not relieve the contractor of supplying all requirements set forth in the specification and drawings. Any substitutions offered by the contractor shall include, as a separate document, any and all differences between the submitted products and the specified products including but not limited to, all dimensions, electrical, control, weights, warranties, country of origin and a statement from the manufacture that no child labor has

been used in the manufacture or assembly of said products and a copy shall be supplied with the product outdoor unit submittal.

E. If submittals contain any proposed alternate equipment specifications, calculations, dimensions, electrical specifications, sound specifications or any other mandated submission which are not accepted, are noted or rejected for any reason the contractor shall be allowed to correct any deficiency and re-submit a second time. Should there be any issues found on second submission the contractor will be directed to and agrees to submit on the original specified products and provide the specified products without any additional compensation.

F. Simultaneous Cooling and Heating VRF System

Heat recovery system shall be an air cooled, system consisting of one to three outdoor unit modules, conjoined to make a 6-42 ton single refrigerant circuit, connected to Heat Recovery (HRU) unit(s) and indoor unit(s). Multi-port heat recovery units shall allow simultaneous heating and cooling of individual zone(s) at various capacities as required to satisfy their zone requirements. Simultaneous heating and cooling shall be supported. The heat recovery system shall consist of three pipes, liquid, suction and hot gas pipes, two pipe heat recovery systems that cannot deliver, at zero degrees outdoor ambient, 162F hot gas to the indoor coils for heat shall not be acceptable.

The heat recovery system shall be capable of operating with <208/230V>or<460V> 60Hz, 3 phase power.

## 1.2 STANDARD/CERTIFICATIONS

A. Variable Refrigerant Flow heat pump systems shall have published performance ratings certified by AHRI (Air-Conditioning, Heating, and Refrigeration Institute) and listed in the AHRI Standard 1230 certified product directory

B. All VRF heat pump system components shall be manufactured in production facilities maintaining the following ISO certifications:

1)ISO 9001 Quality Management System
2)ISO 14001 Environmental Management System

C. All VRF heat pump system components shall comply with Underwriters Laboratories (UL) 1995 4$^{th}$ edition of Heating and Cooling Equipment Standard for Safety and bear the Electrical Testing Laboratories (ETL) mark.

D. All-VRF heat pump system electrical power wiring shall be installed according to National Electrical Code (NEC) and applicable state and local building amendments.

1.3 WARRANTY

A. Please refer to LG web site www.lg-hvac.com for applicable warranty.

PART 2 - PRODUCTS

A. All three-phase heat recovery outdoor units shall be from the same product design. Mixing of different product designs, families, or product lines are not acceptable.

B. All three-phase VRF heat pump and heat recovery outdoor units shall be from the same product development generation. Mixing of outdoor units from different development generations is not acceptable.

C. Outdoor Unit shall be capable of continuous compressor operation between the following operating ambient air conditions, operation outside of these conditions are possible and may involve non-continuous operations.

a) Heat Recovery System
   (i) Cooling: 14°F DB to 122°F DB <With optional low ambient kit from -9.9°F DB to 122°F DB>
   (ii) Heating: -13°F WB to 61°F WB
   (iii) Cooling based synchronous: 14°F DB to 81°F DB
   (iv) Heating-based synchronous: 14°F WB to 61°F WB

D. General features:

a) The air-conditioning system shall use R410A refrigerant.
b) The system shall be capable of an automatic refrigerant charge function for use in both the heat mode and cool mode to ensure the proper amount of refrigerant is installed into the system.
c) Each system shall consist of one, two or three air source outdoor unit modules conjoined together in the field to result in the capacity specified elsewhere in these documents.
d) Dual and triple frame configurations shall be field piped together using manufacturer's designed and supplied Y-branch kits and field provided interconnecting pipe to form a common refrigerant circuit.
e) System shall employ self-diagnostics function to identify any malfunctions and provide type and location of malfunctions via fault alarms.
f) Refrigerant circuit configuration for Heat Recovery System
   (i) The refrigerant circuit shall be constructed using field provided ACR copper, de-hydrated, piped together with manufacturer supplied Heat Recovery unit(s) and Y- branches connected to multiple (ducted, non-ducted or mixed combination) indoor units to effectively and efficiently control the simultaneous heating and cooling operation of the VRF system. Other pipe materials shall not be allowed.

g) Each refrigerant pipe, y-branches, elbows and valves shall be individually insulated with no air gaps. Insulation R-value (thickness) shall not be less than the minimum called for by the local building code, local energy code or as a minimum per manufacture installation requirements. In no case shall the insulation be allowed to be compressed at any point in the system.
   (i) All joints shall be glued and sealed per insulation manufactures instructions to make an air tight assembly..

h) Factory installed microprocessor controls in the outdoor unit(s), HR unit(s), and indoor unit(s) shall perform functions to optimize the operation of the VRF system and communicate in a daisy chain configuration between outdoor unit and HR unit(s) and indoor unit(s) via RS485 network. Controls shall also be available to control other building systems as required from the VRF control system. DIO/AIO capabilities shall be available as well as a central controller to perform operation changes, schedules and other duties as required by this specification. Addition of separate building control system shall not be required. Other control devices and sequences shall be as specified in other sections of this project specification.

i) Inverter PCB cooling: cooling of the inverter PCB shall be conducted by way of passive heat transfer via “Heat Pipe” technology and/ or highly conductive sink method to the outdoor ambient for dissipation to the ambient via natural convection and also by way of forced convection when the outdoor condenser fans are running. Additional cooling of the inverter PCB using mechanical devices other than an existing condenser fans shall not be allowed. Further, use of outdoor coil space or sections to cool inverter PCB shall not be permitted.

j) Compressor control: Fuzzy control logic shall establish and maintain target evaporating temperature (Te) to be constant on cooling mode and condensing temperature (Tc) constant on heating mode by Fuzzy control logic to ensure the stable system performance.

k) Flexible Capacity Control(FCC): (Demand limiting ) The system shall allow for up to 5 steps of flexible capacity control using a manufacturer’s controller or up to 8 steps of flexible capacity control using a BMS control by others. This FCC shall be employed when electrical demand limiting, night time noise reduction or any other flexible capacity control requirement based on any other requirement using contact closures to engage.

l) Integration: each system shall be able to integrate via open protocol via BACnet IP, This gateway converts between BACnet IP or Modbus TCP protocol and RS-485 allowing third party control and monitoring of the A/C system, or LonWorks gateways. See controls specification for more detailed description of integration and points to be controlled and monitored.

m) Smart load control: Smart load control operation shall be available at any time during or after system commissioning.

n) Smart load control shall be initiated by outdoor air temperature and shall automatically adjust the evaporator target (condenser target for heat) pressure / temperature that the system will operate to in order precisely load match the system to the building load as the outdoor ambient increases or decreases, by varying the compression ratios of the system and increase the operating efficiencies by adjusting the compressor lifts. The system shall poll all indoor units’ data in real time and apply

its algorithm to determine the optimal evaporating temperature to satisfy varying loads. Systems that rely on the worst performing zone to reset the system conditions shall not be sufficient and shall not be allowed.

o) Indoor unit connectivity: The system shall be designed to accept connection up to 64 indoor units of various configuration and capacity, depending on the capacity of the system.

p) Power and communication interruption: The system shall be capable of performing continuous operation when an individual or several indoor units are being serviced; communication wire cut or power to indoor unit is disconnected. Systems that alarm and/or shut down because of a lack of power to any number of indoor units shall not be acceptable or allowed.

q) Connection Ratios: The maximum allowable system combination ratio shall be 130%. Systems designed with combination ratio above 130% are not acceptable. The total nominal capacity of all indoor units shall be no less than 50% and no more than 130% of outdoor unit's nominal capacity.

r) The outdoor unit refrigerant circuit shall employ for safety a threaded fusible plug.

s) The unit shall be shipped from the factory fully assembled including internal refrigerant piping, inverter driven compressor(s), controls, contacts, relay(s), fans, power and communications wiring as necessary.

t) Each outdoor unit refrigeration circuit shall include, but not limited to, the following components:
   (i) Refrigerant strainer(s)
   (ii) Check valve(s)
   (iii) Inverter driven, medium pressure vapor injection, high pressure shell compressors
   (iv) Heat pipe cooled inverter PCB
   (v) Oil separator(s)
   (vi) Accumulator(s)
   (vii) 4-way reversing valve(s)
   (viii) Vapor injection valve(s)
   (ix) Variable path heat exchanger control valve(s)
   (x) Oil balancing control
   (xi) Oil Level sensor(s)
   (xii) Electronic expansion valve(s)
   (xiii) Sub-cooler (s)
   (xiv) High and low side Schrader valve service ports with caps.
   (xv) Service valves

E. Refrigerant Flow Control

a) System shall have a variable flow and path outdoor heat exchanger function to vary the refrigerant flow and volume and path. Control of the variable path circuits shall be based on system operating mode and operating conditions as targeted to manage the efficiency of the system.

b) System shall have a medium pressure gas vapor injection function employed in the heating mode to increase system capacity when the outdoor ambient temperatures

are low. The compressor vapor injection flow amount shall be controlled by the VI sub-cooling algorithm reset by discharge gas temperatures of the compressor.

c) System shall have an active refrigerant control and multi section accumulator that dynamically changes the volume of refrigerant circulating in the system based on operating mode and operating conditions to ensure maximum system efficiency.
d) The compressor design shall be of the high pressure shell scroll type where the internal pressure below the suction valves of the compressor shall be same as discharge pressure. The motor shall be cooled by high pressure gas and as a result oil shall be stable and non-foaming increasing the efficiency of the system.
e) The VRF outdoor unit shall include a factory provided and mounted sub-cooler assembly consisting of a double spiral tube-type sub-cooling heat exchanger and EEV providing refrigerant sub-cooling modulation control by fuzzy logic of EEV and by mode of operation to provide capacity and efficiency as required
f) System shall have following frame configurations vs. capacity.
    i. 6 to 14 ton units shall be a single frame only.
    ii. 16 to 28 ton units shall be dual frame only.
    iii. 30 to 42 ton heat recovery units shall be triple frame only

F. Field Supplied Refrigerant Piping Design Parameters

a) The outdoor unit shall be capable of operating at an elevation difference of up to 360 feet above or below the lowest or highest indoor unit respectively without the requirement of field installed sub cooler or other forms of performance enhancing booster devices.
b) The outdoor unit shall be capable of operating with up to 3280 equivalent length feet of interconnecting liquid line refrigerant pipe in the network.
c) The outdoor unit shall be capable of operating with up to 656 actual feet or 738 equivalent length feet of liquid line refrigerant pipe spanning between outdoor unit and farthest indoor unit.
d) The piping system shall be designed with pipe expansion and contraction possibilities in mind. If required expansion devices shall be field designed, supplied and installed based on proper evaluation of the proposed piping design. Piping systems must be installed per manufacturer’s published guidelines
e) Pipe hanger and supports selected should allow for expansion and contraction of the piping system shall not interfere with that movement.

G. Defrost Operations

a) The outdoor unit(s) shall be capable of *Intelligent defrost* operation to melt accumulated frost, snow and ice that may have accumulated on the outdoor unit heat exchanger. The defrost cycle length and sequence shall be based on outdoor ambient temperatures, outdoor unit heat exchanger temperature, and various differential pressure variables.
b) Defrost Mode Selection: The outdoor unit shall be provided with three field selectable defrost operation modes; Normal, Fast, or Forced.

1. *Normal Defrost* operation intended for use in areas of the country with mild winter temperatures and light to moderate humidity levels. The strategy minimizes defrost cycle frequency allowing frozen precipitation to build longer in between cycles. Minimum time between defrost cycles shall be 20 minutes. Intelligent Defrost shall choose between split coil/frame and full system methods to minimize energy consumption and cycle time.
2. *Fast Defrost* operation intended for use in areas of the country that experience adverse winter weather with periods of heavy winter precipitation and extremely low temperatures. This strategy shall maximize the systems heating performance and maintain operational efficiency. When the ambient temperature is above 32°F, Intelligent Defrost shall continue to heat until the discharge temperature declines. At temperatures below 32°F, the time between defrost cycles shall be a minimum of 90 minutes. At temperatures below 4°F, a defrost cycle shall occur every two hours to optimize system heating efficiency.
3. *Forced Defrost* operation shall be available for the service provider to test defrost operations at any weather condition and to manually clear frozen water from the outdoor coil surfaces.

c) Indoor Unit Fan Operation During Defrost
   1. During partial defrost operation indoor units operating in cooling or dry mode shall continue normal operation.
   2. During partial defrost operation, indoor units that are commissioned with fans set for continuous operation shall maintain normal fan speed unless the leaving air temperature drops, then the fan speed will be reduced to low speed for the remainder of the defrost cycle.
   3. During full system defrost operation indoor unit fans will cycle off and remain off during the remainder of the defrost cycle.

H. Oil Management

a) The system shall utilize a high pressure oil return system to ensure a consistent film of oil on all moving compressor parts at all points of operation. Oil is returned to compressor through a separate oil injection pipe directly into the oil sump. Oil returned to the compressor via the suction port of the compressor shall not be allowed
b) Each compressor shall be provided with an independent centrifugal oil separator, designed to extract oil from the oil/refrigerant gas stream leaving the compressor.
c) The system shall have an oil level sensor in the compressor to provide direct oil level sensing data to the main controller.
d) The system shall only initiate an oil return cycle if the sensed oil level is below oil level target values as determined by the microprocessor.
e) A default oil return algorithm shall automatically initiate the oil return mode if the system detects a failure of the oil sump sensor. A fault code shall be reported by the system.
f) Timed oil return operations or systems that do not directly monitor compressor oil level shall not be permitted.
d) Indoor Unit Fan Operation During Oil Return Cycle

1. During oil return cycle indoor units operating in cooling or dry mode shall continue normal operation.
2. During oil return, indoor units that are commissioned with fans set for continuous operation shall maintain normal fan speed unless the leaving air temperature drops, then the fan speed will be reduced to low speed for the remainder of the oil return cycle.

I. Cabinet

a) Outdoor unit cabinet shall be made of 20 gauge galvanized steel with a weather and corrosion resistant enamel finish. Outdoor unit cabinet finish shall be tested in accordance with ASTM B-117 salt spray surface scratch test (SST) procedure for a minimum of 1000 hours. The test report results with photo images shall be included with submittal documentation.
b) The front panels of the outdoor units shall be removable type for access to internal components.
c) A smaller service access panel, not larger than 7” x 7” and secured by a maximum of (2) screws shall be provided to access the following:
   (i) Service tool connection
   (ii) DIP switches
   (iii) Auto addressing
   (iv) Error codes
   (v) Main microprocessor
   (vi) Inverter PCB
d) The cabinet shall have piping knockouts to allow refrigerant piping to be connected at the front, right side, or through the bottom of the unit.

J. Fan Assembly

a) 6 ton frames shall be equipped with one direct drive variable speed propeller fan with Brushless Digitally Controlled (BLDC) motor with a vertical air discharge.
b) 8 to 14 ton frames shall be equipped with two direct drive variable speed propeller fan(s) with BLDC motor(s) with a vertical air discharge.
c) The fan(s) blades shall be made of Acrylonitrile Butadiene Styrene (ABS) material.
d) The fan(s) motor shall be equipped with permanently lubricated bearings.
e) The fan motor shall be variable speed with a maximum operating speed of 1050 RPM.
f) The fan shall have a raised guard to help prevent contact with moving parts.
g) The cabinet shall have option to redirect the discharge air direction from vertical to horizontal with the addition of optional factory provided air guides.
h) The fan controller shall have a DIP switch setting to raise external static pressure of the fan up to 0.32 in-wg to accommodate ducted installations.
i) The fan control shall have a function setting to remove excess snow automatically.

K. Outdoor Unit Coil

a) Shall be comprised of aluminum fins mechanically bonded to copper tubing.
b) The copper tubes shall have inner riffling to expand the total surface of the tube interior.
c) The aluminum fins shall have factory applied corrosion resistant GoldFin™ material with a Hydrophilic top coat.
d) Coil coating shall be tested in accordance with ASTM B-117 salt spray surface scratch test (SST) procedure for a minimum of 1000 hours. The test report results with photo images shall be included with submittal documentation.
e) Shall have multiple circuits designed for path isolation and variable velocity control.
f) Shall be designed, built and provided by the VRF outdoor unit manufacturer
g) The outdoor unit coil, all indoor units and pipe network shall be field tested to a minimum pressure of 550 psig. Manufacturers that do not specify and/or allow field testing at 550 psig shall not be allowed.
h) The outdoor unit coil for each cabinet shall have lanced aluminum fins with a maximum fin spacing of no more than 14 Fins per Inch (FPI). All the outdoor unit coils shall be a minimum of 3 rows consisting of staggered tubes for efficient air flow across the heat exchanger.
i) The cabinet shall have a factory installed coil guard.

L. Compressor(s)

a) Each 6, 8, 10 ton frames shall be equipped with a single hermetically sealed, inverter driven, High Side Shell (HSS) scroll compressor.
b) 12 and 14 ton frames shall be equipped with dual hermetically sealed, inverter driven, High Side Shell (HSS) scroll compressors.
c) Each inverter driven, HSS scroll compressor shall be capable of operating from 15 Hz up to 150 Hz with control in 0.5 Hz increments in any and all modes (cooling OR heating)
d) Manufacturers that employ speed limiting algorithms designed to limit compressor capacity to lower power amperage draw shall not be permitted.
e) The compressor(s) shall be equipped with a 60 Watt crankcase heater controlled by oil temperature.
f) The compressor shall employ a factory metered charge of Polyvinyl Ether (PVE) oil.
g) The compressor shall be designed for a separate port for oil to be directly returned to the compressor oil sump.
h) The compressor bearing(s) shall have Teflon™ coating.
i) The compressor(s) shall be protected with:
   (i) High Pressure switch
   (ii) Over-current /under current protection
   (iii) Oil sump sensor
   (iv) Phase failure
   (v) Phase reversal
   (vi) Compressor shall be capable of receiving injection of medium pressure gas at a point in the compression cycle where such injection shall allow a greater mass

flow of refrigerant at lower outdoor ambient and achieving a higher heating capability.. The VRF outdoor unit shall have published performance data for heating mode operation down to -13F on both heat pump and heat recovery systems.

j) Standard, non-inverter driven compressors shall not be permitted nor shall a compressor without vapor injection or direct sump oil return capabilities.

M. Inverter Compressor Controller(s)

a) The VRF outdoor unit shall be provided with a separate inverter compressor controller PCB for each compressor. Inverter compressor controllers that host more than one compressor shall not be accepted.
b) The inverter compressor controller shall be designed and programmed to utilize the entire range of operation of the connected compressor during cooling cycle operation and/or heating cycle operation.
c) Inverter compressor controllers programmed to limit the compressors heating or cooling capacity to reduce or limit power consumption is not acceptable.

N. Operational Sound Levels

a) Each single frame outdoor unit shall be rated with an operational sound level not to exceed 59.5 dB(A) when tested in an anechoic chamber under ISO 3745 standard at the highest field selectable heating operating modes available. Such documentation shall be presented in all submittals, manufactures who elect to rate their equipment at other than the highest field selectable conditions shall not be allowed
b) A field setting shall be available to program the outdoor unit to reduce sound levels at night, when desired, to a selectable level while still able to meet building load requirement.

O. Sensors

a) Each outdoor unit module shall have
(i) Suction temperature sensor
(ii) Discharge temperature sensor
(iii) Oil level sensor
(iv) High Pressure sensor
(v) Low Pressure sensor
(vi) Outdoor temperature sensor
(vii) Outdoor unit heat exchanger temperature sensor

PART 3 - HEAT RECOVERY UNIT (HRU) (HEAT RECOVERY SYSTEMS ONLY)

3.1 GENERAL
a) HR unit shall be designed and manufactured by the same manufacturer of VRF indoor unit(s) and outdoor unit(s).

b) HR unit casing shall be constructed with galvanized steel.
c) HR unit shall require 208-230V/1-phase/60Hz power supply.
d) HR Unit shall be an intermediate refrigerant control device between the air source outdoor unit and the indoor units to control the systems cooling and heating operation.
e) HR unit shall be engineered to work with a three pipe VRF system comprising of
   (i) High Pressure Vapor Pipe
   (ii) Low Pressure Vapor Pipe
   (iii) Liquid Pipe
f) HR units' main 3 pipe connections shall be capable of series or parallel pipe configuration.
g) The quantity of HR units that can be piped in series shall be limited to 16.
h) A single string of series piped HR units shall be capable of serving any combination of styles of VRF indoor units with a combined nominal capacity of up to 192MBh.
i) HR unit shall have 2, 3 or 4 ports, each port supporting one or more indoor units with a maximum connected capacity of 54 MBH.
j) Each port shall be capable of operating in cooling or heating independently regardless of the operating mode of any other port on the HR unit or in the system.
k) Each port shall be capable of connecting from 1 to 8 indoor units.
l) Connection to Indoor units totaling greater than 54MBh nominal capacity shall be twinned to two adjacent ports of the HRU using a reverse Y-branch connector supplied by manufacture.
m) HR unit shall be internally piped, wired, assembled and run tested at the factory.
n) HR unit shall be designed for installation in a conditioned environment per specifications.
o) HR unit shall employ a liquid bypass valve.
p) HR unit shall have (2) two-position refrigerant valves per port.
q) HR unit shall have a balancing valve to control the pressure between the high pressure and low pressure pipe during mode switching to minimize any change-over pressure related sounds.
r) HR unit shall employ an electronic expansion valve to ensure proper sub cooling of the refrigerant.
s) HRU shall contain one double spiral sub-cooling heat exchanger per port.
t) HR unit shall not require a condensate drain or connection.
u) HR unit shall be internally factory insulated.
v) All field refrigerant lines between outdoor unit and HR unit and from HR unit to indoor unit shall be field ACR tubing, insulated per building or energy code and as instructed by the manufacture.
w) The HR unit shall not exceed a net weight of 50 lbs.
x) HRU's shall not exceed a maximum equivalent pipe length of 8.2 feet.
y) The VRF manufacturer shall provide published documentation that specifically allows the installation of field provided isolation valves on all pipes connected to the Heat Recovery unit to allow the servicing of HR units, refrigerant circuit or the replacement of HR unit without evacuating the balance of the piping system.

3.2 Piping Capabilities

a) The elevation difference between indoor units on heat pump systems shall be 131 feet.
b) The elevation differences for heat recovery systems shall be:
   (i) Heat recovery unit (HRU) to connected indoor unit shall be 49 feet
   (ii) HRU to HRU shall be 49 feet
   (iii) Indoor unit to indoor unit connected to same HRU shall be 49 feet
   (iv) Indoor unit to indoor unit connected to separate parallel piped HRU's shall be 131 feet.
c) The acceptable elevation difference between two series connected HR units shall be 16 feet.

3.3 Controls

a) HR unit(s) shall have factory installed unit mounted control boards and integral microprocessor to communicate with other devices in the VRF system.
b) HR unit shall communicate with the indoor units via a 2-conductor shielded communications cable terminated using a daisy chain configuration.(see instructions regarding the termination of the shield)
c) The contractor is instructed to review the Electrical and ATC drawings and specifications for other items or tasks which this contractor is or may be responsible to provide materials and or labor under this contract. Failure to do so will not relieve this contractor of their responsibility to provide such materials and or labor and in no case shall this contractor be further compensated as a result.
d) Contractor shall adhere to manufacturer's standard control specification.
e) Commissioning shall be performed by the manufacturer or certified installation professional.
f) Controllers shall be stored and protected from weather, extreme temperatures, etc.
g) BACnet Gateway for systems integration shall be provided. LonWorks shall be provided if required by owner's existing BAS Communication Standard.

# SECTION 23 82 39.19 - UNIT HEATERS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes unit heaters with propeller fans and electric-resistance heating coils and units with electric infrared heating elements.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and 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 details of anchorages and attachments to structure and to supported equipment.
4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
5. Wiring Diagrams: Power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For unit heaters to include in emergency, operation, and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Berko; Marley Engineered Products.

2. Chromalox, Inc.
3. Indeeco.
4. Markel Products Company; TPI Corporation.
5. Marley Engineered Products.
6. Ouellet Canada Inc.
7. QMark; Marley Engineered Products.
8. Trane Inc.

2.2 DESCRIPTION

A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 CABINET

A. Front Panel: Stamped-steel louver with removable panels fastened with tamperproof fasteners.

B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

2.4 COIL

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection.

2.5 FAN AND MOTOR

A. Fan: Aluminum propeller directly connected to motor.

B. Motor: Permanently lubricated. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

A. Controls: Wall mounted thermostat with low-voltage relay with transformer kit.

B. Electrical Connection: Factory wire motors and controls for a single field connection.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive wall and ceiling unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install unit heaters to comply with NFPA 90A.

B. Install unit heaters level and plumb.

C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 23 82 39.19

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# SECTION 26 01 00 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK

## PART 1 – GENERAL

### 1.1 DESCRIPTION

A. General Requirements for Electrical Work are intended to be complementary to General Requirements of Construction Contract.

B. Work Included: Provide complete electrical items where shown on Drawings, as specified herein, and as needed for complete and proper installation including, but not necessarily limited to the following summary of Work.

1. A complete electrical system including power, lighting and low voltage systems.
2. A complete system of feeders and branch circuits to supply electrical power for the entire facility.
3. Demolition of existing electrical systems.
4. Interior and exterior luminaries and lamps.
5. Emergency egress luminaries.
6. Wiring devices, outlets, disconnect switches, coverplates, etc.
7. New 2000KVA transformer to replace existing.
8. Complete conduit/raceway system for Fire Alarm systems modifications.

### 1.2 QUALITY ASSURANCE AND APPLICABLE STANDARDS

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the Work of this Section.

B. Without additional cost to the Engineer/Owner, provide such other labor and materials as are required to complete the Work of this Section in accordance with the requirements of Governmental Agencies having jurisdiction, regardless of whether materials and associated labor are delineated elsewhere in these Contract Documents.

C. When requested, provide the Owner’s Authorized Representative with manufacturer’s certificate that materials meet or exceed minimum requirements as specified.

D. Electrical and Fire Alarm Work shall conform to requirements and recommendations of the latest edition of the National Electrical Code and local codes and ordinances. When codes conflict, the more stringent requirements shall govern.

E. Specifications and Standards of the following organizations are by reference made part of these Specifications. Electrical Work, unless otherwise indicated, shall comply with requirements and recommendations wherever applicable:

1. Association of Edison Illuminating Companies (AEIC)
2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)
4. Certified Ballast Manufacturers (CBM)
5. Electrical Testing Laboratories (ETL)
6. Institute of Electrical and Electronic Engineers (IEEE)
7. Insulated Power Cable Engineers Association (IPCEA)
8. National Bureau of Standards (NBS)
9. National Electrical Contractors Association (NECA)
10. National Electrical Manufacturer's Association (NEMA)

11. National Fire Protection Association (NFPA)
12. Radio-Television Manufacturer's Association (RTMA)
13. Reflector Luminaire Manufacturers (RLM)
14. Underwriters' Laboratories, Inc. (UL)

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Requirements and recommendations of the latest editions of the Occupational Safety and Health Act (OSHA), Americans with Disabilities Act (ADA), and the Texas Accessibility Standards (TAS) are by reference made part of these Specifications. Work shall comply with requirements and recommendations wherever applicable.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Other Sections of Divisions 23, 26, and 28.

B. Other Divisions of Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.5 SUBMITTALS

A. Comply with pertinent provisions of Division 01.

B. Submittals required of materials and equipment include following:

1. Materials list of items proposed to be provided under Division 26, 27 and 28.
2. Manufacturer's specifications and other data needed to prove compliance with specified requirements. The term "Compliance" shall mean that the Contractor certifies that submitted equipment meets or exceeds Contract Document requirements. Items that do not clearly meet this definition should be identified and explained as required in the following paragraph.
3. Explain with enough detail so that it can easily be determined that the item complies with the functional intent. List disadvantages or advantages of proposed item versus specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Organize in a clear and concise format. Substitutions must be approved in writing by the Engineer. The Engineer’s decision shall be final.
4. Allow a minimum of ten (10) working days for review of each submittal and resubmittal.
5. Items of equipment that are not accepted in writing as “approved equal” shall be replaced or revised to comply with the Contract Documents at the Contractor's expense.
6. The manufacturer’s recommended installation procedures shall become the basis for accepting or rejecting actual installation procedures used on the Work.
7. Shop drawings shall consist of detailed drawings with dimensions, schedules, weights, capacities, installation details and pertinent information needed to describe the material or equipment.

C. Submittals required of materials and equipment under this Division includes the following listed items not supplied by the Owner. These submittal requirements are intended to be complimentary to the requirements that may be listed in the individual sections. In the event of conflict, more stringent requirement shall apply.

1. Wiring Devices

a. Product Data: For each product type indicated.

b. Submit operation and maintenance data for wiring devices, for inclusion in "Operating and Maintenance Manual" specified in this section.

2. Interior and Exterior Lighting

a. Submit product data describing fixtures, lamps, ballasts, and emergency lighting units. Arrange product data for fixtures in order of fixture designation. Include data on features and accessories.
b. Submit outline drawings indicating dimensions and principal features of fixtures.
c. Submit electrical ratings and photometric data including certified results of laboratory tests for fixtures and lamps.
d. Submit battery and charger data for emergency lighting units.
e. Submit Shop Drawings detailing nonstandard fixtures and indicating dimensions, weights, and methods of field assembly, components, features, and accessories.
f. Submit wiring diagrams detailing wiring for control system showing both factory-installed and field-installed wiring for each specific system which differentiates between factory-installed and field-installed wiring.
g. Submit air and thermal performance data for air-handling fixtures.
h. Submit sound performance data for air-handling fixtures.
i. Submit maintenance data for fixtures to include in the Operation and Maintenance Manual as specified in this Section.

3. Digital Addressable Fire Alarm System

a. The fire alarm system will not be reviewed by the Engineer until the system has been reviewed and approved by the local code authority having jurisdiction.
b. Product Data: Submit digital documentation in a digital format approved by the engineer in advance. Document the type, size, rating, style, catalog number, manufacturer name, photographs, and catalog data sheets for items proposed to meet these specifications. The proposed equipment shall be subject to approval of the Engineer, and no equipment shall be ordered or installed without that approval.
c. Shop Drawings: Submit complete set of digital Shop Drawings, one for each unit sub-assembly that requires that field wire to be connected. Shop Drawings shall be reproduced electronically from a Master Copy supplied by the manufacturer in digital format to match the project specific CADD software.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Shop Drawings shall be prepared by persons with the following qualifications:

a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified fire-alarm technician, Level III minimum.

3. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
4. Record copy of site-specific software.

5. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
6. Frequency of testing of installed components.
7. Frequency of inspection of installed components.
8. Requirements and recommendations related to results of maintenance.
9. Manufacturer's user training manuals.
10. Include voltage drop calculations for notification appliance circuits. Size circuits to provide 20% spare capacity.
11. Include battery-size calculations.
12. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
15. Include on drawings candela ratings of all strobe units

d. Close-out Submittals: Digital copies of following Manual shall be delivered to the Engineer at the time of system acceptance in a digital format approved by the engineer in advance. Close out submittals shall include:

1. Operating manuals covering installed Life Safety System.
2. Point-to-point diagrams of the entire Life Safety System as installed. This shall include connected smoke detectors and addressable field modules. Drawings shall be provided in digital format to match the job specific CADD software. System-generated point-to-point diagrams are required to ensure accuracy.
3. An application program listing for the system as installed at the time of acceptance.
4. Name, address, and telephone number of the authorized factory representative.
5. Drawings must reflect the device address and programmed characteristics as verified in presence of the Engineer and the Owner’s Authorized Representative.
6. “As-Built” riser and wiring diagrams reflecting T-taps and each programmed device characteristic including detector type, base type, address, sensitivity setting, and wire configurations shall be provided to the Engineer.

4. Record Documents. Refer to the “Project Record Documents” paragraph of this Section.
5. Operation and Maintenance Data. Refer to the “Operation and Maintenance Data” paragraph of this Section.

D. Resubmittals of rejected submittals shall be limited to one (1) in number. Costs for processing subsequent resubmittals in excess of the first resubmittal, resulting from the Contractor’s disregard of the Architect/Engineer’s primary submittal rejection comments, shall be borne by the Contractor. Costs shall be based on the Architect/Engineer’s hourly

rates as published in their current professional fee schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost plus ten percent (10%).

1.6 SUBSTITUTIONS

A. The Contract Documents list manufacturers' names and catalog numbers followed by the phrase "or equal" are to establish a standard of quality and utility for the specified items and to provide a dimensional reference to the scaled drawings.

B. Submittals for "equal" items shall include the following data, which is not necessarily required for specified items which list the manufacturer and catalog number:

1. Performance characteristics.
2. Materials.
3. Finish.
4. Certification of conformance with specified codes and standards.
5. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "compliance" is understood to mean that the submitted equipment will meet or exceed the Contract Document requirements. Items that do not clearly meet this definition shall be identified and explained as required in the following Paragraph.
6. Identify the difference between specified equipment and proposed substituted equipment. Explain with enough detail so that the Engineer/Owner can easily determine that the item complies with the functional intent. List disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Organize in a clear and concise format. The Engineer shall approve substitutions in writing. The Engineer’s decision shall be final.

C. Submittals of "equal" components or systems may be rejected if:

1. The material or equipment would necessitate alteration of the mechanical, electrical, architectural, or structural design.
2. Dimensions vary from specified material or equipment so that accessibility or clearances are impaired or Work of other trades is adversely affected.

D. Proposed substitutions for materials or equipment must be submitted ten (10) days prior to final bid date for consideration as approved equals. Otherwise, substitutions will not be permitted. Only prime bidders shall make proposals for substitutions.

E. No substitution shall be made unless authorized in writing by the Engineer. Should substitution be accepted, and should substitute material prove defective or otherwise unsatisfactory for service intended, and within guarantee period, replace this material or equipment with material or equipment specified, to the satisfaction of the Engineer and at no cost to the Engineer/Owner.

1.7 ORDINANCES, PERMITS, METERS, UTILITIES AND ROYALTIES

A. Purchase all necessary permits and licenses necessary for completion of the Work. Pay all lawful fees required and necessary pursuant in obtaining said permits and licenses. Certificates of approvals and inspections by local governing and regulating authorities are required.

B. Pay all fees required for the connection of utility power and telephone services required for the Work.

C. Pay royalty payments or fees required for the use of patented equipment or systems. Defend lawsuits or claims for infringement of the patent rights and hold the Engineer/Owner harmless from loss as result of said suits or claims.

1.8 COMPATIBILITY OF EQUIPMENT

A. Assume full responsibility for the satisfactory operation of component parts of the electrical systems. Assure compatibility of equipment and performance of the integrated systems in accordance with the requirements of the Construction Documents. Notify the Engineer before submitting a bid should the Specifications or Drawings make acceptance of responsibility impossible, prohibitive, or restrictive. The bid shall be accompanied by a written statement listing any objections or exceptions to the applicable specification section and drawing.

1.9 UTILITIES AND TEMPORARY POWER

A. Verify the location and capacity of all existing utility services before starting the Work. The locations and sizes of electrical lines are shown in accordance with data secured from the Owner's survey. The data shown is offered as an estimating guide without guarantee of accuracy.

B. Pay all utility charges for temporary power not paid by the Owner. Provide all temporary lighting and power required. Install in accordance with OSHA requirements and as described in the General Requirements, Division 1.

1.10 FLASHINGS, SLEEVES, AND INSERTS

A. Provide flashings where conduits pass through outside walls. Flashings shall be properly formed to fit around conduit and shall be caulked, with 790 Silicone Building Sealant by the Dow Corning Corporation, so as to make a watertight seal between conduit and building.

B. Unless otherwise specified, install sleeves for each conduit where it may pass through interior walls or floors. Galvanized 22 gage sheet iron sleeves shall be used. Finish flush with each finished wall surface. In pipe chases, the sleeve shall extend 1-1/2 inches above the floor slab and shall be watertight.

C. Raceways that pass through concrete beams or walls and masonry exterior walls shall be provided with galvanized wrought iron pipe sleeves, unless shown otherwise on drawings. Inside diameter of these sleeves shall be at least 1/2 inch greater than outside diameters of service pipes. After pipes are installed in these sleeves, fill annular space between the pipes and sleeves with 790 Silicone Building Sealant by the Dow Corning Corporation. Completed installation shall be watertight.

D. Roof penetrations shall be provided with counter flashings arranged to provide weatherproof installation.

E. Penetrations through walls, floors, and ceilings shall be done in manner to maintain integrity of fire rating of the respective wall, floor, or ceiling.

F. Reference Division 1 for additional sealant requirements. Where conflicts occur with the specified requirements, the more stringent shall apply.

1.11 SURFACE CONDITIONS

A. Examine the areas and conditions under which the Work of this Division will be performed. Work required to correct conditions detrimental to timely and proper completion of Work shall be included as part of the Work of this Division. Do not proceed until unsatisfactory conditions are corrected.

1.12 CONSTRUCTION REQUIREMENTS

A. The drawings show arrangements of the Work. Rearrangement of the spaces and equipment will be considered when the Project conditions make this necessary and materials or equipment can be installed to better advantage. Prior to proceeding with the Work, coordinate with the various trades to prepare and submit five (5) copies of Drawings of the proposed arrangement for the Engineer's review. Allow a minimum of ten (10) working days for review.

B. Installation or rearrangement of the equipment and space for the Contractor's convenience or to accommodate the material or equipment substitutions will be considered. Assume responsibility for rearrangement of equipment and space and have the Engineer review change before proceeding with the Work. Request for changes shall be accompanied by Shop Drawings of the affected equipment and space. Identify proposed monetary credits or other benefits. Allow a minimum of ten (10) working days for review.

C. Properly locate and size all required pipe sleeves and slots, holes, or openings in structure.

1.13 PREPARATION AND COORDINATION

A. Coordinate the work in strict accordance with the Contract Documents as follows:

1. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear encroachment. Shop drawings shall be furnished by this section, indicating all changes to meet space requirements, code requirements, and as necessary to resolve all space conflicts.
2. Install power and control wiring for installation of equipment furnished under Division 23. Furnish disconnect switches and other equipment as required for the proper operation of equipment unless equipment is specified to be factory mounted.

B. Information on the Drawings and in these Specifications is reasonably accurate, but absolute accuracy is not guaranteed. The drawings are diagrammatic, and the exact locations, distances, levels, and other conditions shall be governed by actual construction.

C. Where receptacles are not specifically located on the Drawings, locate as determined in field by the Engineer. Where convenience receptacles are installed without the Engineer's specific direction, relocate as directed by the Engineer at no additional cost to the Owner.

D. Field-verify measurements. No extra compensation will be allowed because of differences between the Work shown on Drawings and actual site measurements.

E. Branch circuit wiring and arrangement of home runs have been designed for maximum economy consistent with adequate sizing and other considerations. Increase size of wiring and wiring systems to accommodate more stringent requirements listed in these Specifications or on the Drawings. Install wiring with circuits arranged as shown on the Drawings, except as otherwise approved in advance by the Engineer.

F. Equipment Layout:

1. The physical location and arrangements of electrical equipment is shown on the Plans and is to be used by the Contractor as a guideline in construction. It is the responsibility of the Contractor to review the Plans with the proposed equipment and equipment of the other trades that are affected, and to ensure that all Code required clearances, wiring distances and maintenance accesses, including equipment heights, of all items are maintained.
2. Alternate arrangements to accomplish the above due to field conditions or changes in physical size of the equipment proposed for the project are to be submitted to the Architect for review before any work is begun or equipment ordered.
3. The alternate arrangement is to be presented in a 1/4 inch scaled drawing showing all equipment, including those of other contractors. Include shop drawing cut sheets and applicable information.
4. Indicate on the drawing by dimension all required Code clearances, wiring distances and maintenance access requirements. Where equipment heights are required to be coordinated with architectural or other items, indicate revised heights.

1.14 PROJECT RECORD DOCUMENTS

A. Provide Project record documents associated with Work in accordance with the provisions of these Specifications. Refer to Division 01 for additional requirements.

B. Throughout progress of the Work, maintain accurate record of all changes in Contract Documents (Drawings and Specifications). Changes shall include Addendums issued during bidding and location of the electrical service lines, receptacles, and outside utilities.

C. Delegate responsibility for maintenance of record documents to one person on the Contractor's staff.

D. Accuracy of Records

1. Thoroughly coordinate changes, making adequate and proper entries on each page of the Specifications and each sheet of the Drawings and other documents. Match symbology and format of base documents.
2. Accuracy of records shall be such that future searches for items shown in Contract Documents may rely reasonably on the information obtained from approved Project record documents.

E. Maintain a job set of record documents protected from deterioration and from loss and damage until completion of Work. Transfer all recorded data to the final Project record documents.

F. Making Entries on Drawings

1. Using erasable colored pencil (not ink or indelible pencil), clearly describe the changes by graphic line and note as required.
2. Date entries.
3. Call attention to the entry by "cloud" drawn around area or areas affected.
4. In event of overlapping changes, use different colors for overlapping changes.
5. Make entries within twenty-four (24) hours after receipt of information that changes have occurred.
6. Maintain base drawing format and use same symbology.

7. Convert field mark-ups to finished CADD record drawings when required in this Section.
8. Convert Schematic Layouts to represent the final installed conditions.

G. Final Project Record Documents

1. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.
2. Provide CADD Electronic files using AutoCAD or REVIT software to match the project specific Release. Upon written request, completion of the release form, and payment of the Engineer's standard fee of $250 for set-up charge and $25 per drawing for copies of such files, the Engineer will provide AutoCAD electronic files of the base Contract Drawings. When applicable, the Engineer will also provide a list of the drawing layers and names that shall be maintained.
3. Provide a complete set of record drawings on one compact disc or other electronic storage media approved by the Engineer.

1.15 OPERATION AND MAINTENANCE DATA

A. Submit digital files of the preliminary draft of the proposed manual or manuals to the Engineer for review and comments. Allow a minimum of ten (10) working days for review.

B. Submit approved manual to the Engineer prior to the indoctrination of the operation and maintenance personnel.

C. Where instruction manuals are required for submittal, they shall be prepared in accordance with the following:

| | |
|---|---|
| Format: Size: | 8-1/2-inch by 11-inch |
| Text: | Neatly written or printed |
| Drawings: | Match the project dimensions. |
| Flysheets: | Separate each section of the Manual briefly describing the contents of ensuing section, flysheets shall be in color. |
| Measurements: | Provide measurements in U.S. standard units (e.g., feet, inches, and pounds). Where items may be expected to be measured within ten (10) years in accordance with the metric formulae, provide additional measurements in "International System of Units" (SI). |

Provide identification for each manual, using a format approved by the Engineer, with at least the following information:

OPERATING AND MAINTENANCE INSTRUCTIONS
Name and Address of Work
Name of the Contractor
General subject of this manual
Space for approval signature of the Engineer and approval date(s)

D. Contents: Include at least the following:

1. Neatly typewritten index near the front of the Manual, giving immediate information as to the location within the manual of the emergency information regarding installation.
2. Complete instructions regarding the operation and maintenance of the equipment involved including lubrication, disassembly, and reassembly.
3. Complete nomenclature of the parts of equipment.
4. Complete nomenclature and part number of the replaceable parts, name and address of nearest vendor and other data pertinent to the procurement procedures.
5. Copy of guarantees and warranties issued.
6. Manufacturer's bulletins, cuts, and descriptive data, where pertinent, clearly indicating precise items included in this installation and deleting, or otherwise clearly indicating, manufacturers' data with which this installation is not concerned.
7. Other data as required in pertinent Sections of these Specifications.

1.16 EQUIPMENT FOUNDATIONS

A. Provide equipment foundations in accordance with the provisions of these Specifications.

B. Provide concrete bases for switchgear, switchboards, distribution panelboards, floor-mounted transformers, and other equipment that is to be pad or floor mounted. Bases shall be four (4) inches high above finished floors or grades (unless otherwise noted) and shall protrude a minimum of two (2) inches beyond the sides of the equipment and shall have exposed chamfered edges. Construct bases from ready-mixed hardrock concrete, ASTM C94, reinforced with #3 rebar, ASTM A615, Grade 40. Rebar shall be located at eighteen (18) inches on center in each direction.

C. Field verify exact location of outdoor pad mounted equipment with the Engineer. Supply necessary fill and grade site to provide natural drainage away from the equipment.

1.17 TESTING AND INSPECTION

A. Provide personnel and equipment, make required tests, and secure required approvals from the Engineer and Governmental Agencies having jurisdiction.

B. Make written notice to the Engineer adequately in advance of each of the following stages of construction:

1. When rough-in is complete, but not covered.
2. At completion of the Work of this Division.
3. In underground condition prior to placing backfill, concrete floor slab, and when associated electrical Work is in place.

C. When material or workmanship is found to not comply with specified requirements, remove items from the job site and replace them with items complying with the specified requirements at no additional cost to the Owner. This shall be performed within three (3) days after receipt of the written notice of noncompliance.

D. In the Engineer’s presence, test parts of electrical system and prove that items provided under this Division function electrically in required manner.

1.18 WARRANTY

A. Warrant equipment and workmanship for a period of one (1) year after the date of substantial completion and replace or repair faulty equipment or installation at no cost to the Owner for service during this period, in accordance with the requirements of Division

B. Warranty shall not void specific warranties issued by the manufacturers for greater periods of time or void rights guaranteed to the Owner by law.

C. Warranties shall be in writing in form satisfactory to the Owner, and shall be delivered to the Owner before final payment is made.

1.19 PROJECT COMPLETION

A. Upon completion of the Work of this Division, thoroughly clean exposed portions of the electrical installation, removing traces of soil, labels, grease, oil, and other foreign material, and using only type cleaner recommended by the manufacturer of item being cleaned.

B. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the operations and maintenance manual required to be submitted as part of this Division of these Specifications.

END OF SECTION

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SECTION 26 01 12 - INTERDISCIPLINARY COORDINATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Refer to the drawings.

1.2 SUMMARY

A. This Section describes the coordination between the Mechanical, Plumbing, Fire Protection, and Electrical portions of the work.

B. This Section is also included under Divisions 21, 22, 26, and 28 portions of the Specifications.

1.3 WORK INCLUDED

A. The Contractor is responsible for the coordination of all the work including work that is not addressed in this section.

B. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. The schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:

| | ITEM | FURNISHED UNDER DIVISION | INSTALLED UNDER DIVISION | WIRED AND CONNECTED UNDER DIVISION |
|---|---|---|---|---|
| 1. | Equipment Motors | Note 9 | Note 9 | 26 |
| 2. | Magnetic motor Starters | | | |
| | a. Automatically controlled, with or without HOA switches. | 26 | 26 | Notes 1,3,5 |
| | b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment. | Note 9 | Note 9 | Notes 1,3,5 |
| | c. Manually controlled | 26 | 26 | Notes 1,3,5 |
| | d. Manually controlled and furnished as part of the factory wired equipment. | Note 9 | Note 9 | Notes 1,3,5 |
| | e. Furnished in motor Control Centers. | 26 | 26 | Notes 1,3,5 |
| 3. | Variable Speed (Frequency) AC Drives. | 23 | 26 | Notes 1,4,5 |
| 4. | Line voltage thermostats, time clocks, etc., not connected to control panel systems. | 23 | 23 | 26 |

| | | | | |
|---|---|---|---|---|
| 5. | Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part of directly attached to ducts, pipes, etc. | 23 | 23 | 23 |
| 6. | Temperature control panels and time switches mounted on temperature control panels. | 23 | 23 | Note 1 |
| 7. | Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc. | 23 | 23 | Note 1 |
| 8. | Alarm bells furnished with equipment installed by Division 23. | 23 | 23 | 23 |
| 9. | Wiring to obtain power for control circuits, including circuit breaker. | 26 | 26 | 26 |
| 10. | Low voltage controls | 23 | 23 | 23 |
| 11. | Fire protection system (sprinkler) controls. | 21 | 21 | Note 8 |
| 12. | Fire and smoke detectors installed on mechanical units and in ductwork. | 26 | 23 | Note 2 |
| 13. | All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with VAC equipment to provide operation and control of HVAC equipment. | 23 | 23 | Note 1 |
| 14. | Smoke dampers, and combination fire/smoke dampers. | 23 | 23 | Note 7 |
| 15. | Boiler and water heater controls, boiler burner controls panels. | 23 | 23 | Note 1 |
| 16. | Pushbutton stations, pilot lights. | 26 | 26 | 26 |
| 17. | Heat Tape. | Note 9 | Note 9 | 26 |
| 18. | Disconnect switches, manual operating switches furnished as a part from equipment. | Note 9 | Note 9 | Notes 1, 5 |
| 19. | Disconnect switches, manual operating switches furnished separate from equipment. | 26 | 26 | 26 |
| 20. | Multispeed switches. | 23 | 23 | 26 |
| 21. | Thermal overloads. | 23 | 23 | 23 |
| 22. | Control relays, transformers. | 23 | 23 | 23 |
| 23. | Refrigeration cycle, cooling tower and controls. | 23 | 23 | 23 |

| | | | | |
|---|---|---|---|---|
| 24. | Tamper switches for fire protection (sprinkler) system. | 21 | 21 | 26 |
| 25. | Flow and/or pressure switches for fire protection (sprinkler) system. | 21 | 21 | 26 |
| 26. | Fire and jockey pump controllers and automatic transfer switch. | 21 | 21 | Note 6 |
| 27. | Alarm bells or horns for fire protection system. | 21 | 21 | 26 |
| 28. | Generator (underground) fuel tank. | 22 | 22 | - |
| 29. | Generator (underground) fuel tank level indicator. | 22 | 22 | 26 |
| 30. | Generator fuel piping from tank to generator. | 22 | 22 | - |
| 31. | Underground fuel tank leak detection and monitoring system. | 22 | 22 | 22 |

Notes

(1) Power wiring as defined in Section 260519 of the specifications shall be provided under Division 26. Control wiring shall be provided under Division 23.

(2) Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 28 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 and 26 specifications and the Drawings for more specific requirements.

(3) For requirements for magnetic motor Starters, refer to Section 262913 – ENCLOSED CONTROLLERS.

(4) For requirements for Variable Speed (Frequency) AC drives, refer to Section 230514 –VARIABLE FREQUENCY DRIVES.

(5) Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.

(6) Power wiring from energy source to controllers and automatic transfer switch shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 23 and conform to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.

(7) Division 28 will provide power to all smoke and combination fire/smoke dampers, including control wiring for all such dampers using area smoke detectors.

(8) Wiring for sprinkler system controls to be provided by Division 21. Wiring from devices to Fire Alarm System to be provided by Division 28.

(9) All components provided with packaged equipment shall be furnished and installed by the Contractor providing the equipment.

B. CONNECTIONS: Make all connections to controls that are directly attached to duct, piping, and mechanical equipment with flexible connections.

C. PRECEDENCE

1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.

2. Precedence for pipe, conduit and duct systems shall be as follows:
   a. Building lines
   b. Structural members
   c. Soil and drain piping
   d. Vent piping
   e. Steam piping
   f. Condensate piping
   g. Refrigerant piping
   h. Electrical bus duct
   i. Supply ductwork
   j. Return ductwork
   k. Exhaust ductwork
   l. Chilled water and heating water piping
   m. Automatic Fire Protection Sprinkler Piping
   n. Natural gas piping
   o. Domestic hot and cold water piping
   p. Electrical conduit

D. FINAL INSPECTION AND REPORT

1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical, Fire Alarm, and Temperature Control Contractors, representatives of mechanical and electrical equipment manufacturers whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of the meeting, listing those in attendance, and the companies that they represent shall be filed with the Owner, Architect, and Engineer of Record.

# SECTION 26 05 13 - MEDIUM-VOLTAGE 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. Section 261219 - Pad mounted liquid filled, medium voltage transformers.

2. Section 260526 - Grounding and bonding for electrical systems.

### 1.2 SUMMARY

A. Section includes cables and related cable splices, terminations, and accessories for medium-voltage (2001 to 35,000 V) electrical distribution systems.

### 1.3 DEFINITIONS

A. Jacket: A continuous nonmetallic outer covering for conductors or cables.

B. NETA ATS: Acceptance Testing Specification.

C. Sheath: A continuous metallic covering for conductors or cables.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of cable. Include splices and terminations for cables and cable accessories.

### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Material Certificates: For each type of cable and accessory.

C. Source quality-control reports.

D. Field quality-control reports.

### 1.6 QUALITY ASSURANCE

A. Installer: Engage a cable splicer, trained and certified by splice material manufacturer, to install, splice, and terminate medium-voltage cable.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 FIELD CONDITIONS

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than five business days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Construction Manager's and Owner's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers

1. Allied Wire and Cable
2. General Cable Products
3. The Okinite Company
4. Southwire Company

B. Cables Splicing and Terminating Products and Accessories

1. Suitable for splicing and terminating the cable to be reused.

C. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2 and NFPA 70.

2.3 CABLES

A. Cable Type: Type MV 105.

B. Comply with UL 1072, AEIC CS8, ICEA S-93-639/NEMA WC 74, and ICEA S-97-682.

C. Conductor: Copper.

D. Conductor Stranding: Compact round, concentric lay, Class B.

E. Strand Filling: Conductor interstices are filled with impermeable compound.

F. Conductor Insulation: Crosslinked polyethylene.

1. Voltage Rating: 15 kV.
2. Insulation Thickness: 133 percent insulation level.

G. Shielding: Solid copper wires helically applied over semiconducting insulation shield.

## 2.4 CONNECTORS

A. Comply with ANSI C119.4 for connectors between aluminum conductors or for connections between aluminum to copper conductors.

B. Copper-Conductor Connectors: Copper barrel crimped or Copper shear bolt connectors as recommended by the transformer and switch manufacturer.

## 2.5 SOLID TERMINATIONS

A. Multiconductor Cable Sheath Seals: Type recommended by seal manufacturer for type of cable and installation conditions, including orientation.

1. Compound-filled, cast-metal-body, metal-clad cable terminator for metal-clad cable with external plastic jacket.
2. Cold-shrink sheath seal kit with preformed sleeve openings sized for cable and insulated conductors.
3. Heat-shrink sheath seal kit with phase- and ground-conductor rejacketing tubes, cable-end sealing boot, and sealing plugs for unused ground-wire openings in boot.
4. Cast-epoxy-resin sheath seal kit with wraparound mold and packaged, two-part, epoxy-resin casting material.

B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class shall be equivalent to that of cable. Include shield ground strap for shielded cable terminations.

1. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone-rubber, insulator modules; shield ground strap; and compression-type connector.
2. Class 1 Terminations: Heat-shrink type with heat-shrink inner stress control and outer nontracking tubes; multiple, molded, nontracking skirt modules; and compression-type connector.
3. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief shield terminator; multiple-wet-process, porcelain, insulator modules; shield ground strap; and compression-type connector.
4. Class 1 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, compression-type connector, and end seal.
5. Class 2 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, and compression-type connector. Include silicone-rubber tape; cold-shrink-rubber sleeve; or heat-shrink, plastic-sleeve moisture seal for end of insulation whether or not supplied with kits.
6. Class 3 Terminations: Kit with stress cone and compression-type connector.

## 2.6 SEPARABLE INSULATED CONNECTORS

A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.

B. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.

C. Load-Break Cable Terminators: Elbow-type units with 200-A-load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

D. Dead-Break Cable Terminators: Elbow-type unit with 200-A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

E. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.

1. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
2. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
3. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.
4. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.

F. Test-Point Fault Indicators: Applicable current-trip ratings and arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.

G. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

## 2.7 SPLICE KITS

A. Splice Kits: Comply with IEEE 404; type as recommended by cable or splicing kit manufacturer for the application.

B. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, materials, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.

1. Combination tape and cold-shrink-rubber sleeve kit with rejacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
2. Heat-shrink splicing kit of uniform, cross-section, polymeric construction with outer heat-shrink jacket.

3. Premolded, cold-shrink-rubber, in-line splicing kit.
4. Premolded, EPDM splicing body kit with cable joint sealed by interference fit of mating parts and cable.
5. Separable multiway splice system with all components for the required splice configuration.

2.8 MEDIUM-VOLTAGE TAPES

A. Ethylene/propylene rubber-based, 30-mil (0.76-mm) splicing tape, rated for 130 deg C operation. Minimum 3/4 inch (20 mm) wide.

B. Silicone rubber-based, 12-mil (0.30-mm) self-fusing tape, rated for 130 deg C operation. Minimum 1-1/2 inches (38 mm) wide.

C. Insulating-putty, 125-mil (3.175-mm) elastic filler tape. Minimum 1-1/2 inches (38 mm) wide.

2.9 ARC-PROOFING MATERIALS

A. Tape for First Course on Metal Objects: 10-mil- (250-micrometer-) thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.

B. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch (8 mm) thick, and compatible with cable jacket.

C. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1 inch (25 mm) wide.

2.10 SOURCE QUALITY CONTROL

A. Test and inspect cables according to ICEA S-97-682 before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cables splices according to IEEE 576.

B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inches (1200 to 1800 mm) on the pull rope.

1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.
2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching

the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.

C. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.
2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.
3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.
4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

E. Properly support cables according to the new transformers and switch A manufacturer’s written instructions.

F. Install terminations at ends of conductors, and seal multiconductor cable ends with standard kits.

G. Install separable insulated-connector components as follows:

1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.
3. Standoff Insulator: At each terminal junction, with one on each terminal.

H. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.

I. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.

J. Install cable splices at pull points and elsewhere as indicated; use standard kits. Use dead-front separable watertight connectors in manholes and other locations subject to water infiltration.

K. Install terminations at ends of conductors, and seal multiconductor cable ends with standard kits.

L. Install separable insulated-connector components as follows:

1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.
3. Standoff Insulator: At each terminal junction, with one on each terminal.

M. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:

1. Clean cable sheath.
2. Wrap metallic cable components with 10-mil (250-micrometer) pipe-wrapping tape.
3. Smooth surface contours with electrical insulation putty.
4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
5. Band arc-proofing tape with two layers of 1-inch- (25-mm-) wide half-lapped, adhesive, glass-cloth tape at each end of the arc-proof tape.

N. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.

O. Ground shields of shielded cable at one point only. Maintain shield continuity and connections to metal connection hardware at all connection points.

P. Identify cables according to Section 260553 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

## 3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
3. Perform direct-current High Potential test of each new conductor according to NETA ATS, Ch. 7.3.3. Do not exceed cable manufacturer’s recommended maximum test voltage.
4. Perform Partial Discharge test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer’s recommendations.
5. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer’s recommendations.

D. Medium-voltage cables and terminations will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports. Submit to the Engineers

END OF SECTION 260513

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# SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Other Sections of Divisions 23, 26, 27 and 28.
2. Other Divisions of Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

### 1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene Monomer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

### 1.6 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.

B. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN.

D. Multi-conductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC, Type SO and Type USE with ground wire.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. Hubbell Power Systems, Inc.
3. Ideal Industries, Inc.
4. O-Z/Gedney.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

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. Service Entrance: Type THHN/THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN/THWN, single conductors in raceway.

F. Feeders in Cable Tray: Type THHN/THWN, single conductors in raceway, Type XHHW-2, single conductors larger than No. 1/0 AWG.

G. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN, single conductors in raceway.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN, single conductors in raceway.

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN, single conductors in raceway.

J. Branch Circuits Installed below Raised Flooring: Type THHN/THWN, single conductors in raceway.

K. Branch Circuits in Cable Tray: Type THHN/THWN, single conductors in raceway, Type XHHW-2, single conductors larger than No. 1/0 AWG.

L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, and strain relief device at terminations to suit application.

## 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 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

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-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 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 260544 "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 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform the following 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.

B. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

# SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes:

1. Grounding conductors.
2. Grounding connectors.
3. Grounding busbars.
4. Grounding rods.
5. Grounding labeling.

B. Provide a new and complete grounding and bonding system and equipment to serve the new transformer assembly.

### 1.3 DEFINITIONS

A. BCT: Bonding conductor for telecommunications.

B. EMT: Electrical metallic tubing.

C. TGB: Telecommunications grounding busbar.

D. TMGB: Telecommunications main grounding busbar.

### 1.4 ACTION SUBMITTALS

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

### 1.5 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. BCT, TMGB, TGBs, and routing of their bonding conductors.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

### 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

    a. Instructions for periodic testing and inspection of grounding features at test wells, ground rings and grounding connections for separately derived systems based on NFPA 70B.

        1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
        2) Include recommended testing intervals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V.

1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
2. Cable Tray Equipment Grounding Wire: No. 8 AWG.

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 (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

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. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. 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.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. 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.

G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Report measured ground resistances that exceed the following values:

1. Substations and Pad-Mounted Equipment: 5 ohms.

G. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance. Provide all labor and material to reduce the ground resistance to the specified value.

END OF SECTION

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# SECTION 26 05 29 - 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. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

### 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 the following:

a. Hangers.
b. Steel slotted support systems.
c. Nonmetallic support systems.
d. Trapeze hangers.
e. Clamps.
f. Turnbuckles.
g. Sockets.
h. Eye nuts.
i. Saddles.
j. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.

1. Trapeze hangers. Include product data for components.
2. Steel slotted-channel systems.
3. Nonmetallic slotted-channel systems.
4. Equipment supports.
5. 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.

### 1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

### 1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

2.2 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. GS Metals Corp.
e. G-Strut.
f. Thomas & Betts Corporation, A Member of the ABB Group.
g. Unistrut; an Atkore International company.
h. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
6. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hilti, Inc.
2. ITW Ramset/Red Head; Illinois Tool Works, Inc.
3. MKT Fastening, LLC.
4. Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of 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; Illinois Tool Works, Inc.
5. MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are 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.

2.3 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 055000 "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 unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted 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.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
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 by means that comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "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 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete" and Section 033053 "Miscellaneous Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 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. Touchup: Comply with requirements in Section 099113 "Exterior Painting", Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" 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 A 780.

END OF SECTION

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# SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Floor boxes.
8. Poke-Thru Assemblies

### 1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.
B. GRC: Galvanized rigid steel conduit.
C. IMC: Intermediate metal conduit.
D. EMT: Electrical metal conduit
E. GRC/PVC: Galvanized Rigid-Steel Conduit with PVC jacket

### 1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

### 1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

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. Allied Tube & Conduit.
2. O-Z/Gedney
3. Southwire Company.
4. Thomas & Betts Corporation, A Member of the ABB Group.
5. Western Tube and Conduit Corporation.
6. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. FMC: Comply with UL 1; zinc-coated steel.

I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:
   a. Material: Steel.
   b. Type: Compression.
3. 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.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

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. AFC Cable Systems, Inc.
2. Arnco Corporation.
3. RACO; Hubbell.
4. Thomas & Betts Corporation, A Member of the ABB Group.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. Rigid HDPE: Comply with UL 651A.

G. Continuous HDPE: Comply with UL 651B.

H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

I. RTRC: Comply with UL 1684A and NEMA TC 14.

J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

K. Fittings for LFNC: Comply with UL 514B.

L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

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. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Hoffman; a brand of Pentair Equipment Protection.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type as indicated on the plans and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

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. Allied Moulded Products, Inc.
2. Hoffman; a brand of Pentair Equipment Protection.

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

2.5 BOXES, ENCLOSURES, AND CABINETS

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. Cooper Technologies Company.
2. EGS/Appleton Electric.
3. Hoffman; a brand of Pentair Equipment Protection.
4. Hubbell Incorporated.
5. O-Z/Gedney.
6. RACO; Hubbell.
7. Thomas & Betts Corporation, A Member of the ABB Group.
8. 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. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. 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.

G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.

L. Gangable boxes are allowed.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type as indicated on the plans with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:

1. NEMA 250, Type as indicated on plans, 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.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 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: EMT
3. Underground Conduit: RNC, Type EPC-80-PVC.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
    d. Gymnasiums.

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 nonmetallic in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size, indoors and 1-inch trade size outdoors.

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 sealants recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel 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. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. 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.

B. 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.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to IMC before rising above floor.

J. 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.

K. 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.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. 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.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. 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.

P. 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.

Q. 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.

R. 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.

S. 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.

T. 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. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

V. 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 RMC and 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 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. 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.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

X. Use LFMC in damp or wet locations subject to severe physical damage.

Y. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Z. 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.

AA. 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.

BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

CC. Locate boxes so that cover or plate will not span different building finishes.

DD. 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.

EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

FF. Set floor boxes level and flush with finished floor surface.

GG. Set nonmetallic floor boxes level. Trim after installation to fit 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 260010 "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 260010.

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

# SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS 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. 260513 - medium voltage cables.

### 1.2 SUMMARY

A. Section Includes:

1. Concrete-encased conduit, ducts, and duct accessories.

### 1.3 DEFINITIONS

A. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include duct-bank materials, including separators and miscellaneous components.
2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include warning tape.

B. Shop Drawings:

1. Include plans, elevations, sections, details, attachments to other work, and accessories.
2. Include duct entry provisions, including locations and duct sizes.
3. Include reinforcement details.
4. Include grounding details.
5. Include joint details.

### 1.5 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

B. Source quality-control reports.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.7 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than five business days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Construction Manager's and Owner's written permission.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

A. Comply with ANSI C2.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512, Type EPC-80 and Type EPC-40, with matching fittings complying with NEMA TC 3 by same manufacturer as the existing duct.

B. Underground Plastic Utilities Duct: NEMA TC 6 & 8, ASTM F 512, UL 651A, Type HDPE and Type EB-20-PVC, with matching fittings complying with NEMA TC 9 by same manufacturer as the existing duct.

C. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."
3. Concrete Warning.

a. Color: Red dye added to concrete during batching.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect and Engineer if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of ducts and duct-bank entrances into the new transformer with final locations and profiles, as determined by coordination with underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that the new duct runs drain properly with the existing duct and as approved by Engineer.

C. Clear and grub vegetation to be removed, and protect vegetation to remain. Remove and stockpile topsoil for reapplication.

3.2 EARTHWORK

A. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

B. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

C. Cut and patch existing pavement in the path of underground ducts and utility structures.

3.3 DUCT INSTALLATION

A. Install ducts according to NEMA TCB 2.

B. Slope: Pitch ducts a minimum slope to match the existing duct for proper drainage.

C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.

D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

E. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

F. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes.

1. Begin change from regular spacing to end-bell spacing from the end bell without reducing duct line slope and without forming a trap in the line.
2. Grout end bells into structure walls from both sides to provide watertight entrances.

G. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

H. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in empty ducts.

I. Concrete-Encased Ducts: Support ducts on duct separators.

1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms.
2. Width: Excavate trench 12 inches wider than duct bank on each side.
3. Width: Excavate trench 3 inches wider than duct bank on each side.
4. Depth: Match depth of existing duct. Notify the Engineer if the top of duct bank is not at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
5. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
6. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
7. Minimum Space between Ducts: 3 inches (75 mm) between ducts and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.
8. Elbows: Use manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Extend concrete encasement throughout length of elbow.
9. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.

10. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
11. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
12. Concrete Cover: Install a minimum of 3 inches (75 mm) of concrete cover at top and bottom, and a minimum of 2 inches (50 mm) on each side of duct bank.
13. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion

fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.

b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (15-mm) reinforcing-rod dowels extending a minimum of 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.

14. Pouring Concrete: Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

J. Warning Tape: Bury warning tape approximately 6 inches above all duct banks. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

## 3.4 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

## 3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull solid aluminum or wood test mandrel through existing duct and the new duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch- (150-mm-) long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

## 3.6 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

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# SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels, including arc-flash warning labels.
8. Miscellaneous identification products.

### 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 electrical identification products.

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

C. Delegated-Design Submittal: For arc-flash hazard study.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. 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 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on a white field.
2. Legend: Indicate voltage and system or service type.

B. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

C. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2.3 TAPES AND STENCILS:

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

C. Underground-Line Warning Tape

1. Tape:

a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
b. Printing on tape shall be permanent and shall not be damaged by burial operations.
c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

2. Color and Printing:

a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE"
c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

D. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.4 SIGNS

A. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

a. For signs up to 20 sq. inches, minimum 1/16 inch thick.
b. For signs larger than 20 sq. inches, 1/8 inch thick.
c. Engraved legend with white letters on a black background>.
d. Self-adhesive.
e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

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 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

I. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

J. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color

markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

K. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.3 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

B. 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: Use colors listed on plans in “GENERAL NOTES FOR ALL ELECTRICAL WORK”.

C. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.

E. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive vinyl labels with the conductor designation.

F. Conductors To Be Extended in the Future: Attach marker tape to conductors and list source.

G. 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 operation and maintenance manual.

H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

1. Install underground-line warning tape for direct-buried cables and cables in raceways.

I. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

J. 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.

K. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.

1. Comply with NFPA 70E and ANSI Z535.4.
2. Comply with Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.

L. 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.

M. 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.

N. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine plastic 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. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment To Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
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. Substations.
h. Emergency system boxes and enclosures.
i. Motor-control centers.
j. Enclosed switches.
k. Enclosed circuit breakers.
l. Enclosed controllers.
m. Variable-speed controllers.
n. Push-button stations.
o. Power-transfer equipment.
p. Contactors.
q. Remote-controlled switches, dimmer modules, and control devices.
r. Battery-inverter units.
s. Battery racks.
t. Power-generating units.
u. Monitoring and control equipment.
v. UPS equipment.

END OF SECTION

# SECTION 26 12 19 - PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

## 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. Section 260513 - Medium Voltage Cables

2. Section 260526 - Grounding and Bonding for Electrical Systems

### 1.2 SUMMARY

A. Section includes pad-mounted, liquid-filled, medium-voltage distribution transformers, with primary and secondary bushings within or without air-terminal enclosures.

B. Work Included:

1. Install one (1) new pad mounted transformer including pad mounted compartment for medium and low voltage sections. Remove and dispose of the existing transformer and pad.

2. Provide a new concrete base and grounding as required to accommodate the new equipment and meet the specified installation requirements. Pad shall comply with NEC 450.27. Provide and submit to the engineer transformer pad design shop drawings signed by a registered structural engineer in Texas.

3. Connect the new transformer to the existing primary service from switch A. Provide all labor and materials to modify the existing service to accommodate the new transformer assembly.

4. Connect the new transformer to the existing building low voltage switch gear. Reuse the existing service bus way. Provide all labor and materials to modify the existing service to accommodate the new transformer.

5. Clean and inspect the low 480V service entrance bus way. Inspect all mechanical connections between the new transformers and the existing switchgear. Provide a written report to the engineer documenting the condition and corrective actions. Provide all labor and materials to correct deficiencies.

6. Determine the time current coordination between the existing switch A primary fuse and the transformer fuse. Submit time current curves to the engineer showing that reasonable coordination is achieved. Replace the switch A fuse if required by the engineer.

7. Remove the existing TXU kwh meter and return to owner. Install new current transformers (CT’s) for reconnecting existing Schneider electric PM 750 meter to the campus remote monitoring system.

8. Schedule and phase the construction to minimize the disruption of power to the facility. Do not interrupt power without written authorization from the owner.

9. Visit the site and field. Verify dimensions and site conditions prior to bid and prior to starting the work.

1.3 DEFINITIONS

A. BIL: Basic Impulse Insulation Level.

B. Bushing: An insulating structure including a central conductor, or providing a central passage for a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purpose of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.

C. Bushing Elbow: An insulated device used to connect insulated conductors to separable insulated connectors on dead-front, pad-mounted transformers and to provide a fully insulated connection. This is also called an "elbow connector."

D. Bushing Insert: That component of a separable insulated connector that is inserted into a bushing well to complete a dead-front, load break or nonload break, separable insulated connector (bushing).

E. Bushing Well: A component of a separable insulated connector, either permanently welded or clamped to an enclosure wall or barrier, having a cavity that receives a replaceable component (bushing insert) to complete the separable insulated connector (bushing).

F. Elbow Connector: See "bushing elbow" above.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: For pad-mounted, liquid-filled, medium-voltage transformers.

1. Include plans and elevations showing major components and features.

a. Include a plan view and cross section of equipment base, showing clearances, required workspace, and locations of penetrations for grounding and conduits.

b. Include cross section of the medium and low voltage sections showing conductor terminations and routing.

2. Include details of equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include single-line diagram.
4. Include list of materials.
5. Include nameplate data.

6. Manufacturer's published time-current curves of the transformer high-voltage fuses, with transformer damage curve, inrush curve, and thru fault current indicated. Demonstrate coordination with existing switch A.
7. New concrete pad design signed and sealed by a registered Texas professional structural engineer.
8. New grounding system plan and grounding test report.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

B. Qualification Data: For testing agency.

C. Seismic Qualification Certificates: For transformer assembly, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity, and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For transformers, signed by product manufacturer.

E. Source quality-control reports.

F. Field quality-control reports.

G. Current transformers to serve Schneider electric PM 750 meter.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformer and accessories to include in emergency, operation, and maintenance manuals.

B. Test reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2.

C. Comply with IEEE C57.12.00.

2.2 Acceptable Manufacturers

A. Eaton/Cooper

B. Schneider/Square D

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: The transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the transformer will remain in place without separation of any parts when subjected to the seismic forces specified and the transformer will be fully operational after the seismic event."

B. Windings Material: Aluminum.

C. Surge Arresters: Comply with IEEE C62.11, Distribution Class; metal-oxide-varistor type, fully shielded, separable-elbow type, suitable for plugging into the inserts provided in the high-voltage section of the transformer. Connected in each phase of incoming circuit and ahead of any disconnecting device.

D. Winding Connections: The connection of windings and terminal markings shall comply with IEEE C57.12.70.

E. Efficiency: Comply with 10 CFR 431, Subpart K.

F. Insulation: Transformer kVA rating shall be as follows: The average winding temperature rise above a 30 deg C ambient temperature shall not exceed 65 deg C and 80 deg C hottest-spot temperature rise at rated kVA when tested according to IEEE C57.12.90, using combination of connections and taps that give the highest average winding temperature rise.

G. Tap Changer: External handle, for de-energized operation.

H. Tank: Sealed, with welded-on cover. Designed to withstand internal pressure of not less than 7 psi (50 kPa) without permanent distortion and 15 psig (104 kPa) without rupture. Comply with IEEE C57.12.36.

I. Enclosure Integrity: Comply with IEEE C57.12.28 for pad-mounted enclosures that contain energized electrical equipment in excess of 600 V that may be exposed to the public.

J. Mounting: An integral skid mounting frame, suitable to allow skidding or rolling of transformer in any direction, and with provision for anchoring frame to pad.

K. Insulating Liquids:

1. Schneider/squareD r-temp insulating fluid or Cooper envirotemp FR3 fluid.

L. Sound level shall comply with NEMA TR 1 requirements.

M. Corrosion Protection:

1. Transformer coating system shall be factory applied, complying with requirements of IEEE C57.12.28, in manufacturer's standard color green.
2. Fabricate front sill, hood, and tank base of single-compartment transformers from stainless steel according to ASTM A 167, Type 304 or 304L, not less than No. 13 U.S. gage, complying with requirements of IEEE C57.12.28, standard color green.
3. Base and Cabinets of Two Compartment Transformers: Fabricate from stainless steel according to ASTM A 167, Type 304 or 304L, not less than No. 13 U.S. gage. Coat transformer with manufacturer's standard green color coating complying with requirements of IEEE C57.12.28, in manufacturer's standard color green.

## 2.4 THREE-PHASE TRANSFORMERS

A. Description:

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with IEEE C57.12.26.

B. Compartment Construction:

1. Double-Compartment Construction: Individual compartments for high- and low-voltage sections, formed by steel isolating barriers that extend full height and depth of compartments, with hinged, lift-off doors and three-point latching, with a stop in the open position and provision for padlocking.

C. Primary Fusing: Designed and rated to provide thermal protection of transformer by sensing overcurrent and high liquid temperature.

1. 150-kV BIL current-limiting fuses, conforming to requirements of IEEE C37.47.
2. Interrupting Rating: 50,000 rms A symmetrical at system voltage.
3. Coordinate fuse with existing switch A fuse.

D. High-Voltage Section: Dead-front design.

1. To connect new primary cable, use separable insulated connectors. Bushings shall be one-piece units, with ampere and BIL ratings the same as connectors.
2. Bushing inserts:

    a. Conform to the requirements of IEEE 386.
    b. Rated at 200 A, with voltage class matching connectors. Provide a parking stand near each bushing well.
    c. Provide insulated protective caps for insulating and sealing out moisture from unused bushing inserts.

3. Access to liquid-immersed fuses.
4. Dead-front surge arresters.
5. Tap-changer operator.
6. Load-Break Switch:

a. Radial-feed, liquid-immersed type with voltage class and BIL matching that of separable connectors, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 12 kA rms symmetrical.

7. Ground pad. Provide new.

E. Low-Voltage Section:

1. Bushings with spade terminals drilled for connecting to the existing building service bus duct.
2. Metering: Coordinate with and comply with requirements of the campus remote monitoring.

a. Existing kilowatt-hour meter – remove and return to owner.

b. Remove and reinstall the existing Schneider electric PM 750 meter. Provide new current transformers (CT's) that comply with the PM 750 manufacturer specifications. Provide all labor and materials to reconnect to the existing wiring serving the campus remote monitoring system and provide a complete working system. Demonstrate to the owner and engineer that the reinstalled system is operating correctly and accurately.

F. Capacities and Characteristics:

1. Power Rating (kVA): 2000.
2. Voltage Ratings: 13,000V - 480Y/277 V.
3. Taps: Comply with IEEE C57.12.26 requirements.
4. Transformer BIL (kV): Comply with IEEE C57.12.26 requirements.
5. Minimum Tested Impedance (Percent at 85 deg C): 5.75.
6. K-factor: complying with UL 1562.
7. Comply with FM Global Class No. 3990.
8. Comply with UL listing requirements for combination classification and listing for transformer and less-flammable insulating liquid.

G. Transformer Accessories:

1. Drain and filter connection.
2. Filling and top filter press connections.
3. Pressure-vacuum gauge.
4. Dial-type analog thermometer with alarm contacts.
5. Magnetic liquid level indicator with high and low alarm contacts.
6. Automatically resetting pressure-relief device. Device flow shall be as recommended by manufacturer.
7. Stainless-steel ground connection pads.
8. Machine-engraved nameplate, made of anodized aluminum or stainless steel.

## 2.5 SERVICE CONDITIONS

A. Transformers shall be suitable for operation under service conditions specified as usual service conditions in IEEE C57.12.00, except for the following:

1. Exposure to hot and cold climate conditions typical for Wichita Falls, Texas.
2. Exposure to seismic shock.

## 2.6 WARNING LABELS AND SIGNS

A. Comply with requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."

1. High-Voltage Warning Label: Provide self-adhesive warning signs suitable for outdoor locations on outside of high-voltage compartment door(s). Sign legend shall be "DANGER HIGH VOLTAGE" printed in two lines of nominal 2-inch- ((50-mm)-)high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background.
2. Arc Flash Warning Label: Provide self-adhesive warning signs suitable for outdoor locations on outside of high-voltage compartment door(s), warning of potential electrical arc flash hazards and appropriate personal protective equipment required.

## 2.7 SOURCE QUALITY CONTROL

A. Provide manufacturer's certificate that the transformer design tests comply with IEEE C57.12.90.

1. Perform the following factory-certified routine tests on transformer:

a. Resistance.
b. Turns ratio, polarity, and phase relation.
c. Transformer no-load losses and excitation current at 100 percent of ratings.
d. Transformer impedance voltage and load loss.
e. Operation of all devices.
f. Lightning impulse.
g. Low frequency.
h. Leak.
i. Transformer no-load losses and excitation current at 110 percent of ratings.
j. Insulation power factor.
k. Applied potential.
l. Induced potential.
m. Resistance measurements of all windings on rated voltage connection and at tap extreme connections.
n. Ratios on rated voltage connection and at tap extreme connections.
o. Polarity and phase relation on rated voltage connection.
p. No-load loss at rated voltage on rated voltage connection.
q. Exciting current at rated voltage on rated voltage connection.
r. Impedance.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine pad-mounted, liquid-filled, medium-voltage transformers upon delivery.

1. Upon delivery of transformers and prior to unloading, inspect equipment for any damage that may have occurred during shipment or storage.
2. Verify that tie rods and chains are undamaged and tight, and that all blocking and bracing is tight. Verify that there is no evidence of load shifting in transit, and that readings from transportation shock recorders, if equipped, are within manufacturer's recommendations.
3. Verify that there is no indication of external damage and no dents or scratches in doors and sill, tank walls, radiators and fins, or termination provisions.
4. Verify that there is no evidence of insulating-liquid leakage on transformer surfaces, at weld seams, on high- or low-voltage bushing parts, and at transformer base.
5. Verify that there is positive pressure or vacuum on tank. Check pressure gauge; it is required to read other than zero.
6. Compare transformers and accessories received with bill of materials to verify that shipment is complete. Verify that transformers and accessories conform with manufacturer's quotation and shop drawings. If shipment is incomplete or does not comply with Project requirements, notify manufacturer in writing immediately.
7. Verify presence of polychlorinated biphenyl content labeling.
8. Unload transformers carefully, observing all packing label warnings and handling instructions.
9. Open termination compartment doors and inspect components for damage or displaced parts, loose or broken connections, cracked or chipped insulators, bent mounting flanges, dirt or foreign material, and water or moisture.

B. Handling:

1. Handle transformers carefully, in accordance with manufacturer recommendations, to avoid damage to enclosure, termination compartments, base, frame, tank, and internal components. Do not subject transformers to impact, jolting, jarring, or rough handling.
2. Protect transformer termination compartments against entrance of dust, rain, and snow.
3. Transport transformers upright, to avoid internal stresses on core and coil mounting assembly and to prevent trapping air in windings. Do not tilt or tip transformers.
4. Verify that transformer weights are within rated capacity of handling equipment.
5. Use only manufacturer-recommended points for lifting, jacking, and pulling. Use all lifting lugs when lifting transformers.
6. Use jacks only at corners of tank base plate.
7. Use nylon straps of same length to balance and distribute weight when handling transformers with a crane.
8. Use spreaders or a lifting beam to obtain a vertical lift and to protect transformer from straps bearing against enclosure. Lifting cable pull angles may not be greater than 15 degrees from vertical.
9. Exercise care not to damage tank base structure when handling transformer using skids or rollers. Use skids to distribute stresses over tank base when using rollers under large transformers.

C. Storage:

1. Store transformers in accordance with manufacturer's recommendations.
2. Transformers may be stored outdoors. If possible, store transformers at final installation locations on concrete pads. If dry concrete surfaces are unavailable, use pallets of adequate strength to protect transformers from direct contact with ground. Ensure transformer is level.
3. Ensure that transformer storage location is clean and protected from severe conditions. Protect transformers from dirt, water, contamination, and physical damage. Do not store transformers in presence of corrosive or explosive gases. Protect transformers from weather when stored for more than three months.
4. Store transformers with compartment doors closed.

5. Regularly inspect transformers while in storage and maintain documentation of storage conditions, noting any discrepancies or adverse conditions. Verify that an effective pressure seal is maintained using pressure gauges. Visually check for insulating-liquid leaks and rust spots.

D. Examine areas and space conditions for compliance with requirements for pad-mounted, liquid-filled, medium-voltage transformers and other conditions affecting performance of the Work.

E. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements and connection to the existing medium and low voltage systems.
2. Entries are within conduit-entry tolerances specified by manufacturer, and no feeders will cross section barriers to reach load or line lugs.

F. Provide a new concrete base suitable for conditions and the transformer installation. Provide a shop drawing showing the new pad design to the engineer signed and sealed by the registered structural engineer in the state of Texas. Reference Section 260100 paragraph 1.16 for additional requirements. Pad shall comply with NEC 450.27.

G. Pre-Installation Checks:

1. Verify removal of any shipping bracing after placement.
2. Remove a sample of insulating liquid according to ASTM D 923. Insulating-liquid values shall comply with NETA ATS, Table 100.4. Sample shall be tested for the following:

a. Dielectric Breakdown Voltage: ASTM D 877 or ASTM D 1816.
b. Acid Neutralization Number: ASTM D 974.
c. Specific Gravity: ASTM D 1298.
d. Interfacial Tension: ASTM D 971.
e. Color: ASTM D 1500.
f. Visual Condition: ASTM D 1524.
g. Water in Insulating Liquids: Comply with ASTM D 1533.
h. Power Factor or Dissipation Factor: ASTM D 924.

H. Verify that the ground connections are in place and that requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at transformer location. Provide written test report to the engineer.

I. Proceed with installation only after unsatisfactory conditions have been corrected. Provide all labor and materials at no additional cost.

## 3.2 INSTALLATION

A. Install transformers on cast-in-place concrete equipment base.

B. Transformer shall be installed level and plumb and shall tilt less than 1.5 degrees while energized. Modify the existing base as required.

C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and IEEE C2.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. For counterpoise, use tinned bare copper cable not smaller than No. 4/0 AWG, buried not less than 30 inches (765 mm) below grade interconnecting the grounding electrodes. Bond surge arrester and neutrals directly to transformer enclosure and then to grounding electrode system with bare copper conductors, sized as shown. Keep lead lengths as short as practicable, with no kinks or sharp bends.
2. Make joints in grounding conductors and loops by exothermic weld or compression connector.
3. Terminate all grounding and bonding conductors on a common equipment grounding terminal on transformer enclosure.
4. Complete transformer tank grounding and lightning arrester connections prior to making any other electrical connections.

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

1. Maintain air clearances between energized live parts and between live parts and ground for exposed connections in accordance with manufacturer recommendations.
2. Bundle associated phase, neutral, and equipment grounding conductors together within transformer enclosure. Arrange conductors such that there is not excessive strain that could cause loose connections. Allow adequate slack for expansion and contraction of conductors.

C. Terminate the existing medium-voltage cables in incoming section of transformers according to the manufacturer’s written instructions and Section 260513 “Medium Voltage Cables”.

3.4 SIGNS AND LABELS

A. Comply with installation requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."

B. Install warning signs as required to comply with 29 CFR 1910.269.

3.5 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 as follows:

1. General Field-Testing Requirements:

a. Comply with provisions of NFPA 70B Ch. "Testing and Test Methods."
b. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
c. After installing transformer but before primary is energized, verify that grounding system at the transformer is tested at specified value or less.
d. After installing transformer and after electrical circuitry has been energized, test for compliance with requirements.
e. Visual and Mechanical Inspection:

1) Verify equipment nameplate data complies with Contract Documents.
2) Inspect bolted electrical connections for high resistance using one of the following two methods:

a) Use a low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
b) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In absence of manufacturer's published data, use NETA ATS, Table 100.12.

f. Remove and replace malfunctioning units and retest.
g. Prepare test and inspection reports. Record as-left set points of all adjustable devices.

2. Medium-Voltage Surge Arrester Field Tests:

a. Visual and Mechanical Inspection:

1) Inspect physical and mechanical condition.
2) Verify arresters are clean.
3) Verify that ground lead on each device is individually attached to a ground bus or ground electrode.

b. Electrical Test:

1) Perform an insulation-resistance test on each arrester, phase terminal-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Replace units that fail to comply with recommended minimum insulation resistance listed in that table.

3. Liquid-Filled Transformer Field Tests:

a. Visual and Mechanical Inspection:

1) Test dew point of tank gases if applicable.
2) Inspect anchorage, alignment, and grounding.
3) Verify bushings are clean.
4) Verify that alarm, control, and trip settings on temperature and level indicators are set and operate within manufacturer's recommended settings.
5) Verify that liquid level in tanks is within manufacturer's published tolerances.
6) Perform specific inspections and mechanical tests recommended by manufacturer.
7) Verify presence of transformer surge arresters and that their ratings are as specified.
8) Verify that as-left tap connections are as specified.
9) Verify the correct operation of the Schneider PM 750 meter and campus monitoring system.

b. Electrical Tests:

1) Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index; the value of the index shall not be less than 1.0.
2) Perform power-factor or dissipation-factor tests on all windings according to test equipment manufacturer's published data. Maximum winding insulation power-factor/dissipation-factor values shall be according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.3.
3) Measure core insulation resistance at 500-V dc if the core is insulated and the core ground strap is removable. Core insulation-resistance values shall not be less than 1 megaohm at 500-V dc.
4) Perform a power-factor or dissipation-factor tip-up test on windings greater than 2.5 kV.
5) Perform turns-ratio tests at tap positions. Turns-ratio test results shall not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
6) Perform an excitation-current test on each phase. The typical excitation-current test data pattern for a three-legged core transformer is two similar current readings and one lower current reading. Investigate and correct if test shows a different pattern.
7) Measure resistance of each winding at each tap connection, and record temperature-corrected winding-resistance values in the Operations and Maintenance Manual.
8) Perform an applied-voltage test on high- and low-voltage windings-to-ground. Comply with IEEE C57.12.91, Sections 10.2 and 10.9.
9) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
10) Remove a sample of insulating liquid according to ASTM D 923, and perform dissolved-gas analysis according to IEEE C57.104 or ASTM D 3612.

## 3.6 FOLLOW-UP SERVICE

A. Voltage Monitoring and Adjusting: After Substantial Completion, if requested by Owner, but not more than six months after Final Acceptance, perform the following voltage monitoring:

1. During a period of normal load cycles as evaluated by Owner, perform seven days of three-phase voltage recording at the outgoing section of the transformer. Use voltmeters with calibration traceable to the National Institute of Science and Technology standards and with a chart speed of not less than 1 inch (25 mm) per hour. Voltage unbalance greater than 1 percent between phases, or deviation of any phase voltage from the nominal value by more than plus or minus 5 percent during test period, is unacceptable.
2. Corrective Action: If test results are unacceptable, perform the following corrective action, as appropriate:

    a. Adjust transformer taps.

3. Retests: Repeat monitoring, after corrective action is performed, until satisfactory results are obtained.
4. Report:

    a. Prepare a written report covering monitoring performed and corrective action taken.

B. Infrared Inspection: Perform survey during periods of maximum possible loading. Remove all necessary covers prior to inspection.

1. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of transformer's electrical power connections.
2. Instrument: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 deg C at 30 deg C.
3. Record of Infrared Inspection: Prepare a certified report that identifies testing technician and equipment used, and lists results as follows:

    a. Description of equipment to be tested.
    b. Discrepancies.
    c. Temperature difference between area of concern and reference area.
    d. Probable cause of temperature difference.
    e. Areas inspected. Identify inaccessible and unobservable areas and equipment.
    f. Identify load conditions at time of inspection.
    g. Provide photographs and thermograms of deficient area.

4. Act on inspection results according to recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

5. Submit a written test report to the engineer.

## 3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION 261219

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SECTION 26 24 16 - 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. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. SPD: Surge protective device.

G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

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 including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
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. Key interlock scheme drawing and sequence of operations.
9. 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.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 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. Keys: Two spares for each type of panelboard cabinet lock.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 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.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, 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.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no less than one week in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURE

A. Manufacturer: Provide product by (no substitutes):

1. Square D; by Schneider Electric.

2.2 PANELBOARDS REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: Flush or Surface-mounted, dead-front cabinets as indicated on the plans.

1. Rated for environmental conditions at installed location, unless noted otherwise on the plans.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Kitchen Areas: NEMA 250, Type 1, stainless steel cover.
d. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Height: 84 inches maximum.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Finishes:

    a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Same finish as panels and trim.

E. Incoming Mains:

1. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

F. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

    a. Plating shall run entire length of bus.
    b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box, where required, refer to plans.
5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
6. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter. Refer to plans for panels requiring 200 percent neutral bus.

G. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.

9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

H. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices as indicated on the plans.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

## 2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: As indicated on the plans.

C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

E. Column-Type Panelboards: Where indicated on the plans, provide a single row of overcurrent devices.

1. Doors: Concealed hinges secured with multipoint latch with tumbler lock; keyed alike.

## 2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:

    a. RMS sensing.
    b. Field-replaceable rating plug or electronic trip.
    c. Digital display of settings, trip targets, and indicated metering displays.
    d. Multi-button keypad to access programmable functions and monitored data.
    e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
    f. Integral test jack for connection to portable test set or laptop computer.
    g. Field-Adjustable Settings:

        1) Instantaneous trip.
        2) Long- and short-time pickup levels.
        3) Long and short time adjustments.
        4) Ground-fault pickup level, time delay, and I squared T response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Subfeed Circuit Breakers: Vertically mounted.
9. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Breaker handle indicates tripped status.
    c. UL listed for reverse connection without restrictive line or load ratings.
    d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    f. Ground-Fault Protection: **Integrally mounted** relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
    i. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
    j. Auxiliary Contacts: One, SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    k. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
    l. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

m. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
n. Multipole units enclosed in a single housing with a single handle.
o. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handles in off position.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: 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, 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. Equipment Mounting:

1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in other sections of these specifications.
2. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.

J. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.

K. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

L. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

M. Install filler plates in unused spaces.

N. For recessed panelboards, stub six (6) 1-inch empty EMT conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub six (6) 1-inch empty conduits into raised floor space or below slab not on grade.

## 3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Do not perform optional tests. 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 panelboard. 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 panelboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study".

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

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SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Isolated-ground receptacles.
4. Hospital-grade receptacles.
5. Tamper-resistant receptacles.
6. Weather-resistant receptacles.
7. Snap switches and wall-box dimmers.
8. Solid-state fan speed controls.
9. Wall-switches.
10. Occupancy Sensors.
11. Switch mounted Occupancy Sensors.

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 premarking 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.

PART 2 - PRODUCTS

1.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
2. Hubbell Incorporated; Wiring Device-Kellems.
3. Leviton Manufacturing Co., Inc.
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.

1.2 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.

1.3 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.

B. Convenience Duplex Receptacles with Combination USB Charger, 125V, 20A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 & UL 1310

1. 20A duplex receptacle
2. Dual USB charging ports
3. USB Power Supply – 5V/DC 2.1A minimum
4. Tamper Resistant

C. Hospital-Grade, Duplex 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. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.

D. 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. 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.

E. 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. Description: Labeled shall comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

1.4 GFCI RECEPTACLES

A. General Description:

Straight blade, non-feed-through type.
Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
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:

C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

D. Hospital-Grade, Duplex GFCI 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.

1.5 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.

1.6 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.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
2. 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.

1.7 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

C. Pilot-Light Switches, 20 A:

Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:

Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1.8 OCCUPANCY SENSORS

A. Manufacturers: Refer to plans for manufacturer and model numbers of occupancy sensors used for design. Provide occupancy sensors equal to the devices specified on the plans.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. 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.
6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. 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.
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.

D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.

1. Detector Sensitivity: 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.
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch-high ceiling.
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 (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot-high ceiling in a corridor not wider than 14 feet.

E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is 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.

1.9 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Refer to plans for manufacturer and model numbers of occupancy sensors used for design. Provide occupancy sensors equal to the devices specified on the plans.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent 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: PIR.
3. Switch Type: Single- or dual-pole as indicated on the plans with manual "on," automatic "off."
4. Voltage: Dual voltage, 120 and 277 V.

5. 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.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

1.10 HIGH-BAY OCCUPANCY SENSORS

A. Manufacturers: Refer to plans for manufacturer and model numbers of occupancy sensors used for design. Provide occupancy sensors equal to the devices specified on the plans.

B. General Description: Solid-state unit. The unit is designed to operate with the lamp and ballasts indicated.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Turn lights on when coverage area is occupied, and to half-power when unoccupied; with a time delay for turning lights to half-power that is adjustable over a minimum range of 1 to 16 minutes.
3. Continuous Lamp Monitoring: When lamps are dimmed continuously for 24 hours, automatically turn lamps on to full power for 15 minutes for every 24 hours of continuous dimming.
4. Operating Ambient Conditions: 32 to 149 deg F.
5. Mounting: Threaded pipe.
6. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
7. Detector Technology: PIR.

C. Detector Coverage: User selectable by interchangeable PIR lenses, suitable for mounting heights from 12 to 50 feet.

D. Accessories: Obtain manufacturer's installation and maintenance kit with laser alignment tool for sensor positioning and power port connectors.

1.11 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 toggle switch; with single-pole, three- or four-way switching. Comply with UL 1472.

C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

1.12 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: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Galvanized steel.

4. Material for Damp Locations: Thermoplastic spring-loaded lift cover, and listed and labeled for continuous 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 and rated for continuous use..

1.13 FINISHES

A. Device Color:

Coordinate with the Architect or Owner.

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

1.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

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 service poles to suit arrangement of partitions and furnishings.

1.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

1.3 SENSOR INSTALLATION

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 systems, and partition assemblies.

B. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

C. Provide the correct quantity of Power Packs for the switching shown on the plans. Power Packs are not shown on the plans.

1.4 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes. Provide labeling for light switches on the inside of the wall plate.

1.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
Test Instruments: Use instruments that comply with UL 1436.
Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

Line Voltage: Acceptable range is 105 to 132 V.
Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
Ground Impedance: Values of up to 2 ohms are acceptable.
GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
Using the test plug, verify that the device and its outlet box are securely mounted.
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. Test straight-blade convenience outlets in patient-care areas and hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

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SECTION 26 51 16 - 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 fluorescent lamps and ballasts.
2. Interior solid-state luminaires that use LED technology.
3. Luminaire supports.

B. Related Requirements:

1. Refer to Lighting Fixture Schedule on the plans.
2. Section 262726 “Wiring Devices”.

1.3 DEFINITIONS

A. BIM: Building information model.

B. CAD: Computer-aided design.

C. CCT: Correlated color temperature.

D. CRI: Color Rendering Index.

E. Fixture: See "Luminaire."

F. IP: International Protection or Ingress Protection Rating

G. HID: High-intensity discharge.

H. LED: Light-emitting diode.

I. Lumen: Measured output of lamp and luminaire, or both.

J. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Ballast, including BF.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Include photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides,

of each luminaire type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the luminaire as applied in this Project.

7. 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.
8. Air and Thermal Performance Data: For air-handling luminaires. Furnish data required in "Action Submittals" Article in Section 233713 "Diffusers, Registers, and Grilles."
9. Sound Performance Data: For air-handling luminaires. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Section 233713 "Diffusers, Registers, and Grilles."

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. Product Schedule: For luminaires and lamps. 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 ballast for bi-level and dimmer-controlled luminaires, from manufacturer.

C. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in 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: Ten 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.
3. Fluorescent-luminaire-mounted emergency battery pack: One for every 20 emergency lighting unit.
4. Globes and Guards: One for every 20 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 is accredited under the NVLAP 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 NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

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: Two years 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 for hazardous locations 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.

E. Lamp base complying with ANSI C81.61.

F. Nominal Operating Voltage: Refer to Lighting Fixture Schedule on the plans.

G. Recessed Luminaires: Comply with NEMA LE 4.

H. Air-Handling Fluorescent Luminaires: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Section 233713 "Diffusers, Registers, and Grilles."

1. Air-Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
2. Heat-Removal Units: Air path leads through lamp cavity.
3. Combination Heat-Removal and Air-Supply Unit: Heat is removed through lamp cavity at both ends of the luminaire door with air supply same as for air-supply units.

4. Dampers: Operable from outside luminaire for control of return-air volume.
5. Static Luminaire: Air-supply slots are blanked off, and luminaire appearance matches active units.
6. Refer to the Lighting Fixture Schedule to see if required.

2.2 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A.
5. THD Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 or higher.
10. Power Factor: 0.95 or higher.
11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T5, T5HO and T8 lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.

D. Electromagnetic Ballasts: Comply with ANSI C82.11; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

E. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F and Higher: Electronic type rated for 0 deg F starting and operating temperature with indicated lamp types.
2. Temperatures Minus 20 Deg F and Higher: Electromagnetic type designed for use with indicated lamp types.

F. Ballasts for Low-EMI Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on EMI and RFI for consumer equipment.

G. Ballasts for Dimmer-Controlled Luminaires: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

4. Control: Coordinate wiring from ballast to control device to ensure that ballast, controller, and connecting wiring are compatible.

H. Ballasts for Bi-Level Controlled Luminaires: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level operation and off.

a. High-Level Operation: 100 percent of rated lamp lumens.
b. Low-Level Operation: 30 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

## 2.3 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. THD Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.95 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on EMI and RFI for nonconsumer equipment.

## 2.4 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast. Comply with UL 924.

1. Emergency Connection:

a. Linear Fluorescent Lamp: Operate two linear fluorescent lamps continuously at an output of 1400 lumens each.
b. Compact Fluorescent Lamp: Operate one linear fluorescent lamp continuously at an output of 1250 lumens each.
c. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.

2. 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.

3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

2.5 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32-W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI of 85 (minimum), color temperature of **3500K**, and average rated life of 20,000 hours unless otherwise indicated.

B. Compact Fluorescent Lamps: Four-pin, CRI of 85 (minimum), color temperature of **3500K**, average rated life of 10,000 hours at three hours of operation per start, and/or suitable for use with dimming ballasts unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.6 LED LAMPS AND DRIVER REQUIREMENTS

A. CRI of minimum 80. CCT of **3500K**.

B. Rated lamp life of 50,000 hours.

C. Lamps dimmable from 100 percent to 0 percent of maximum light output.

D. Internal driver.

E. Nominal Operating Voltage: Refer to Lighting Fixture Schedule on the plans.

2.7 BALLASTS FOR HID LAMPS

A. Electronic Ballast for Metal Halide Lamps: Include the following features unless otherwise indicated:

1. Minimum Starting Temperature: Minus 20 deg F for single-lamp ballasts.
2. Rated Ambient Operating Temperature: 130 deg F.
3. Lamp end-of-life detection and shutdown circuit.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 20 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.5 or less.
8. Power Factor: 0.90 or higher.
9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
10. Protection: Class P thermal cutout.
11. Instant-Restrike Device: Integral with ballast or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
12. Minimum Starting Temperature: Minus 40 deg F.

2.8 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: 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.

C. Diffusers and Globes: Refer to Lighting Fixture Schedule on the plans.

D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.9 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.

2.10 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish shall match luminaire.

C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Remote Mounting of Ballasts: Distance between the ballast and luminaire shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

C. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

D. Install lamps in each luminaire.

E. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them.

F. 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 vertical force of 400 percent of luminaire weight.

G. Ceiling-Grid-Mounted Luminaire Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inches from luminaire corners.
2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
3. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

H. Flush-Mounted Luminaire Support:

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.

I. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

J. Suspended Luminaire Support:

1. Refer to Lighting Fixture Schedule for type of hanging supports.
2. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

B. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

C. Luminaire will be considered defective if it does not pass operation tests and inspections.

D. Prepare test and inspection reports.

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# SECTION 26 56 17 - 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 fluorescent lamps and ballasts.
2. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
3. Luminaire-mounted photoelectric relays.

B. Related Requirements:

1. Refer to Lighting Fixture Schedule on the plans.
2. Section 262726 “Wiring Devices”.

### 1.3 DEFINITIONS

A. BIM: Building information model.

B. CAD: Computer-aided design.

C. CCT: Correlated color temperature.

D. CRI: Color Rendering Index.

E. Fixture: See "Luminaire."

F. IP: International Protection or Ingress Protection Rating

G. HID: High-intensity discharge.

H. LED: Light-emitting diode.

I. Lumen: Measured output of lamp and luminaire, or both.

J. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

K. Pole: Luminaire support structure, including tower used for large-area illumination.

### 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 the luminaires.
4. Ballast, including BF.

5. Lamps, including life, output (lumens, CCT, and CRI), and energy-efficiency data.
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, ballasts, and accessories identical to those indicated for the luminaire as applied in this Project.

    a. Manufacturers' 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. Photoelectric relays.
8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of the following:

1. Ballast for bi-level and dimmable luminaires.
2. Lamp.
3. Photoelectric relay.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer or qualified testing agency.

E. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and photoelectric relay to include in o operation and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.
5. Ballasts: 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 manufacturers' laboratory accredited under the NVLAP 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 NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

C. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.10 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.

1.11 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, ballasts, and accessories.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two years 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 comply with UL 1598 and 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. Nominal Operating Voltage: Refer to Lighting Fixture Schedule on the plans.

H. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

2.2 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32-W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI of 85 (minimum), color temperature of **3500K**, and average rated life of 20,000 hours unless otherwise indicated.

2.3 BALLASTS FOR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A.
5. THD Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.8 or higher.
10. Power Factor: 0.95 or higher.

B. Electronic Programmed-Start Ballasts for T5, T8 and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.

C. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F and Higher: Electronic type rated for 0 Deg F starting and operating temperature with indicated lamp types.
2. Temperatures minus 20 Deg F and Higher: Electromagnetic type designed for use with indicated lamp types.
3. Control: Coordinate wiring from ballast to control device to ensure that ballast, controller, and connecting wiring are compatible.

2.4 LED LAMPS AND DRIVER

A. CRI of minimum 80. CCT of 3500K.

B. L70 lamp life of 50,000 hours.

C. Lamps dimmable from 100 percent to 0 percent of maximum light output.

D. Internal driver.

E. Nominal Operating Voltage: Refer to Lighting Fixture Schedule on the plans.

F. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

2.5 BALLASTS FOR HID LAMPS

A. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Minimum Starting Temperature: Minus 20 deg F for single-lamp ballasts.
2. Rated Ambient Operating Temperature: 130 deg F.
3. Lamp end-of-life detection and shutdown circuit.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 20 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.5 or less.
8. Power Factor: 0.90 or higher.
9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
10. Protection: Class P thermal cutout.
11. Instant-Restrike Device: Integral with ballast or solid-state potted module, factory installed within luminaire and compatible with lamps, ballasts, and mogul sockets up to 150 W.
12. Minimum Starting Temperature: Minus 40 deg F.

2.6 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.7 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Refer to Lighting Fixture Schedule on the plans.

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. Ballast shall automatically disconnect when door opens.

D. Diffusers and Globes: Refer to Lighting Fixture Schedule on the plans.

E. 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.

F. 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," including specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.8 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish shall match luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

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 poles, luminaire-mounting devices and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

D. Examine walls, roofs, canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Install lamps in each luminaire.

C. Fasten luminaire to structural support.

D. 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.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.

F. Wiring Method: Install cables in raceways. Conceal raceways and cables.

G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.

H. Install luminaires at height and aiming angle as indicated on Drawings.

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground Nonmetallic Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundation.

3.5 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 260533 "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.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Verify operation of photoelectric controls.

C. Luminaire will be considered defective if it does not pass tests and inspections.

D. 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.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

3.9 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

END OF SECTION

SECTION 28 01 12 - INTERDISCIPLINARY COORDINATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Refer to Section 283111 – DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

1.2 SUMMARY

A. This Section describes the coordination between the Mechanical, Plumbing, Fire Protection, and Electrical portions of the work.

B. This Section is also included under Divisions 21, 22, 26, and 28 portions of the Specifications.

1.3 WORK INCLUDED

A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. The schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:

| | ITEM | FURNISHED UNDER DIVISION | INSTALLED UNDER DIVISION | WIRED AND CONNECTED UNDER DIVISION |
|---|---|---|---|---|
| 1. | Equipment Motors | Note 9 | Note 9 | 26 |
| 2. | Magnetic motor Starters | | | |
| | a. Automatically controlled, with or without HOA switches. | 26 | 26 | Notes 1,3,5 |
| | b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment. | Note 9 | Note 9 | Notes 1,3,5 |
| | c. Manually controlled | 26 | 26 | Notes 1,3,5 |
| | d. Manually controlled and furnished as part of the factory wired equipment. | Note 9 | Note 9 | Notes 1,3,5 |
| | e. Furnished in motor Control Centers. | 26 | 26 | Notes 1,3,5 |
| 3. | Variable Speed (Frequency) AC Drives. | 23 | 26 | Notes 1,4,5 |
| 4. | Line voltage thermostats, time clocks, etc., not connected to control panel systems. | 23 | 23 | 26 |
| 5. | Electric thermostats, time clocks, remote bulb | 23 | 23 | 23 |

| | | | | |
|---|---|---|---|---|
| | thermostats, motorized valves, float controls, etc. which are an integral part of directly attached to ducts, pipes, etc. | | | |
| 6. | Temperature control panels and time switches mounted on temperature control panels. | 23 | 23 | Note 1 |
| 7. | Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc. | 23 | 23 | Note 1 |
| 8. | Alarm bells furnished with equipment installed by Division 23. | 23 | 23 | 23 |
| 9. | Wiring to obtain power for control circuits, including circuit breaker. | 26 | 26 | 26 |
| 10. | Low voltage controls | 23 | 23 | 23 |
| 11. | Fire protection system (sprinkler) controls. | 21 | 21 | Note 8 |
| 12. | Fire and smoke detectors installed on mechanical units and in ductwork. | 26 | 23 | Note 2 |
| 13. | All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with VAC equipment to provide operation and control of HVAC equipment. | 23 | 23 | Note 1 |
| 14. | Smoke dampers, and combination fire/smoke dampers. | 23 | 23 | Note 7 |
| 15. | Boiler and water heater controls, boiler burner controls panels. | 23 | 23 | Note 1 |
| 16. | Pushbutton stations, pilot lights. | 26 | 26 | 26 |
| 17. | Heat Tape. | Note 9 | Note 9 | 26 |
| 18. | Disconnect switches, manual operating switches furnished as a part from equipment. | Note 9 | Note 9 | Notes 1, 5 |
| 19. | Disconnect switches, manual operating switches furnished separate from equipment. | 26 | 26 | 26 |
| 20. | Multispeed switches. | 23 | 23 | 26 |
| 21. | Thermal overloads. | 23 | 23 | 23 |
| 22. | Control relays, transformers. | 23 | 23 | 23 |
| 23. | Refrigeration cycle, cooling tower and controls. | 23 | 23 | 23 |
| 24. | Tamper switches for fire protection (sprinkler) system. | 21 | 21 | 26 |

| | | | | |
|---|---|---|---|---|
| 25. | Flow and/or pressure switches for fire protection (sprinkler) system. | 21 | 21 | 26 |
| 26. | Fire and jockey pump controllers and automatic transfer switch. | 21 | 21 | Note 6 |
| 27. | Alarm bells or horns for fire protection system. | 21 | 21 | 26 |
| 28. | Generator (underground) fuel tank. | 22 | 22 | - |
| 29. | Generator (underground) fuel tank level indicator. | 22 | 22 | 26 |
| 30. | Generator fuel piping from tank to generator. | 22 | 22 | - |
| 31. | Underground fuel tank leak detection and monitoring system. | 22 | 22 | 22 |

Notes

(1) Power wiring as defined in Section 260519 of the specifications shall be provided under Division 26. Control wiring shall be provided under Division 23.

(2) Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 28 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 and 26 specifications and the Drawings for more specific requirements.

(3) For requirements for magnetic motor Starters, refer to Section 262913 – ENCLOSED CONTROLLERS.

(4) For requirements for Variable Speed (Frequency) AC drives, refer to Section 230514 –VARIABLE FREQUENCY DRIVES.

(5) Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.

(6) Power wiring from energy source to controllers and automatic transfer switch shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 23 and conform to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.

(7) Division 28 will provide power to all smoke and combination fire/smoke dampers, including control wiring for all such dampers using area smoke detectors.

(8) Wiring for sprinkler system controls to be provided by Division 21. Wiring from devices to Fire Alarm System to be provided by Division 28.

(9) All components provided with packaged equipment shall be furnished and installed by the Contractor providing the equipment.

B. CONNECTIONS: Make all connections to controls that are directly attached to duct, piping, and mechanical equipment with flexible connections.

C. PRECEDENCE

1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.

2. Precedence for pipe, conduit and duct systems shall be as follows:
   a. Building lines
   b. Structural members
   c. Soil and drain piping
   d. Vent piping
   e. Steam piping
   f. Condensate piping
   g. Refrigerant piping
   h. Electrical bus duct
   i. Supply ductwork
   j. Return ductwork
   k. Exhaust ductwork
   l. Chilled water and heating water piping
   m. Automatic Fire Protection Sprinkler Piping
   n. Natural gas piping
   o. Domestic hot and cold water piping
   p. Electrical conduit

D. FINAL INSPECTION AND REPORT

1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical, Fire Alarm, and Temperature Control Contractors, representatives of mechanical and electrical equipment manufacturers whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of the meeting, listing those in attendance, and the companies that they represent shall be filed with the Owner, Architect, and Engineer of Record.

# SECTION 28 31 11 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables

C. Section 260533 – Raceway and Boxes for Electrical Systems

### 1.2 SUMMARY

A. Section Includes:

1. Fire alarm control panels.
2. Fire alarm initiating devices.
3. Fire alarm notification appliances.
4. Auxiliary fire alarm equipment.

B. System to be designed and built as complete, working installation, monitoring test and upgrade provision by licensed fire alarm contractor in local jurisdiction. Design must be submitted to and approved by AHJ before start of Work and before submitting to Engineer for review. Refer to submittal sections below.

C. Owner will not allow change Orders. Include anticipated Fire Marshall requirements in design and installation of fire alarm system.

D. Drawings from Engineer are diagrammatic, and show approximate locations and devices needed for project. Do not use drawings for submittals, but design system by NICET certified engineer as complete, working installation making changes to drawings as required. Follow NFPA, local, state codes and requirements of Authority Having Jurisdiction (AHJ) for final submitted and approved design.

### 1.3 REFERENCES

A. NFPA 70 - National Electric Code.

B. NFPA 72 - National Fire Alarm Code.

C. NFPA 101 - Life Safety Code.

### 1.4 SYSTEM DESCRIPTION

A. Provide all materials, labor and auxiliaries required for a complete extension of existing fire alarm systems as specified herein and indicated on drawings.

### 1.5 ACTION SUBMITTALS

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

B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in "Documentation" Section of "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72, and requirements specified in Section 260010.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1. Drawings showing location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of detector.
2. Design Calculations: Calculate requirements for selecting spacing and sensitivity of detection, complying with NFPA 72.

D. Reference Section 260100 1.5 for additional requirements.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 260100 "Operation and Maintenance Data," deliver copies to authorities having jurisdiction and include the following:

1. Comply with "Records" Section of "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in "Records" Section of "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of same name and include the following:

   a. Frequency of testing of installed components.
   b. Frequency of inspection of installed components.
   c. Requirements and recommendations related to results of maintenance.

d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.

4. Printout of software application and graphic screens.

1.8 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. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 5 units.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 5 units.
3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 2 units of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 2 units of each type.
5. Keys and Tools: One extra set for access to locked and tamper proofed components.
6. Audible and Visual Notification Appliances: Two of each type installed.
7. Fuses: Four of each type installed in system.

1.9 PROJECT RECORD DOCUMENTS

A. Submit according to provisions of Section 260010.

B. Record actual locations of initiating devices, signaling appliances, and end-of-line devices.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit according to provisions of Section 260010.

B. Operation Data: Operating instructions.

C. Maintenance Data: Maintenance and repair procedures.

1.11 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Owner in writing no fewer than 2 business days in advance of proposed interruption of fire-alarm service.

2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

1.12 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring. Keep removed equipment in good order and turn over to Owner for possible reuse elsewhere or with new system if it is compatible.

1.13 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. 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 to include operating system. Upgrade to include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.
2. Verify compatibility with the campus central monitoring system. Notify the Owner of any deficiencies or upgrades before installing the new software.

1.14 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, NFPA 72, NFPA 101, and International Fire Code.

B. Furnish products listed and classified by UL FM and acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.15 MAINTENANCE SERVICE

A. Furnish service and maintenance of fire alarm system for one year from Date of Substantial Completion.

1.16 EXTRA MATERIALS

A. Furnish according to provisions of Section 260010.

B. Provide ten manual station break-glass rods.

C. Provide six keys of each type.

D. Provide three of each type of automatic smoke detector without base and audio/visual device.

PART 2 - PRODUCTS

2.1 FIRE ALARM AND SMOKE DETECTION CONTROL PANEL

A. Modify the existing Fire Alarm Control Panel as required to accommodate the new devices indicated on the plans. Provide complete battery calculations for the entire existing system plus the new load. Increase battery, power supply, notification appliance circuit modules, initiating de- vice circuit modules and signal circuit wiring as required.

2.2 INITIATING DEVICES

A. Manual Station: Semi-Flush, Surface mounted, coded, non-coded type, single action, double action manual station with break-glass rod. Provide manufacturer's standard backbox.

B. Spot Heat Detector: Fixed temperature, Combination rate-of-rise and fixed temperature, rated 135 degrees F (57 degrees C), and temperature rate of rise of 15 degrees F (8.3 degrees C).

C. Ceiling Mounted Smoke Detector: NFPA 72, ionization type, photoelectric type with adjustable sensitivity, plug-in base, auxiliary relay contact, integral thermal element rated 135 degrees F (57 degrees C), and visual indication of detector actuation, suitable for mounting on 4-inch (102mm) outlet box. Provide two-wire detector with common, four-wire detector with separate power supply and signal circuits.

D. Duct Mounted Smoke Detector: NFPA 72, ionization type, photoelectric type with auxiliary SPOT relay contact, key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing. Provide two-wire detector with common, four-wire detector with separate power supply and signal circuits.

E. Flame Detector: NFPOA 72, ultraviolet, infrared radiation type.

2.3 NOTIFICATION APPLIANCES

A. Alarm Lights: NFPA 72, UL 1971 and ADA compliant, strobe lamp and flasher with red lettered "FIRE" on clear lens.

B. Alarm Horn: NFPA 72, flush fire alarm horn. Sound Rating: 87dB at 10 feet. Provide UL 1971 and ADA compliant, integral strobe lamp and flasher with red lettered "Fire" on clear lens.

2.4 AUXILIARY DEVICES

A. Door Release: Door closer as specified in Section 08710. Magnetic door holder with integral diodes to reduce bussing. Coil voltage: 24 VDC, 120 VAC.

B. Control Relays: UL listed SPOT or DPDT 10 amp rated contacts, status LED. Provide metal enclosure with LED Viewing Port.

2.5 FIRE ALARM WIRE AND CABLE

A. Fire Alarm Power Branch Circuits: Building wire as specified in Section 260519.

B. Initiating Device and Indicating Appliance Circuits: Building wire as specified in Section 260519. Non-power limited fire-protective signaling cable, copper conductor, 150-volt insulation rated 60 degrees C. Power limited fire-protective signaling cable, copper conductor, 300 volts insulation rated 105 degrees C, suitable for use in air handling ducts, hollow spaces used as ducts and plenums.

C. System Circuit Wiring:

1. All multiplex data transmission circuits shall be NFPA 72, Style 7, supervised signaling line circuits from the remote data transponders to the central control computer.
2. All multiplex data transmission circuits shall be NFPA 72, Style 7, supervised signaling line circuits from the fire alarm control panel to the Campus networked fire alarm system.
3. All fire alarm initiating device circuits shall be NFPA 72, Style B, electrically supervised circuits from the FACP, remote data transponders or point addressable interface modules to the devices.
1. All fire alarm point addressable circuits shall be NFPA 72, Style 4, supervised signaling line circuits from the FACP or remote data transponders to the point addressable sensors or point addressable interface modules.
4. All horn/strobe notification appliance circuits shall be NFPA 72, Style Y, electrically supervised circuits from the FACP or data transponders to the appliances.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install manual station 4 feet above floor to the top. Install notification appliances lower of 6 inches below ceiling to the top or 80 inches above the finished floor to the bottom.

C. Mount end-of-line device in control panel box with last device or separate box adjacent to last device in circuit.

D. Mount outlet box for electric door holder to withstand 80 pounds (36.4 kg) pulling force.

F. Make conduit and wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, duct smoke detectors.

G. Device colors to match existing. Strobe and horn/strobe devices are white and fire pull stations are red.

H. Automatic Detector Installation: Conform to NFPA72.

I. Comply with Section 260533 "Raceway and Boxes for Electrical Systems".

J. Exposed areas shall have wiring installed in steel conduit with steel connectors or approved raceway, parallel to existing building structure.

K. Exposed conduit or wire mold will require painting to blend with architecture. Exposed raceway requires prior approval of the Architect.

L. All riser wiring and wiring between floors shall be installed in conduit.

M. FMC runs shall not exceed eight feet.

N. Concealed wiring may be plenum cable (see NFPA 70, NEC per application) and bundled and secured in a proper manner.

O. All wire installed for this project shall be new and be UL listed for use in fire alarm systems.

P. Strap or bundle all cables and wires inside equipment enclosures and terminal cabinets, parallel to the enclosure sides.

Q. Wire:

1. Wire used for 120 VAC power circuits shall be minimum of 12 AWG standard copper conductors, with THHN insulation.
2. Wire used for 24 VDC power circuits and strobe circuits shall be minimum 14 AWG solid copper conductors, with TFN insulation and UL listed for fire alarm use and labeled FPL.
3. Wire used for point addressable, signaling line circuits, and Network transmission systems shall be minimum 18 AWG solid copper conductor, UL listed for fire alarm system use and labeled FPL.
4. Wire shall be UL listed for use in fire alarm signaling systems or as required by NFPA 70, Article 760. All wire shall be solid conductors of copper, minimum size No. 18 AWG and insulation rated at 300 volts.

3.2 FIELD QUALITY CONTROL

A. Field tests to be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Tests and Inspections:

1. Visual inspection: conduct visual inspection prior to testing.
   a. Inspection to be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in "Documentation" Section of 'Fundamentals of Fire Alarm Systems Chapter.
   b. Comply with "Visual Inspection Frequencies" Table in "Inspection" Section of "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.

2. System Testing: Comply with "Test Methods" Table in "Testing" Section of "Inspection, Testing and Maintenance" Chapter in NFPA 72.

3. Test audible appliances for public operating mode according to manufacturer's written instructions. Perform test using portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for private operating mode according to manufacturer's written instructions.
5. Test visible appliances for public operating mode according to manufacturer's written instructions.
6. Test and verify the proper communication and reporting to the Campos central monitoring system. Provide labor and materials to correct deficiencies related to the work of this project.

7. Factory-authorized services representative to prepare “Fire Alarm System record of completion” in “Documentation” Section of “Fundamentals of Fire Alarm Systems” Chapter in NFPA 72 and Inspection and Testing Form” in “Records” Section of “Inspection, Testing and maintenance” Chapter in NFPA 72.

D. Re-acceptance Testing: Perform re-acceptance testing to verify proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
F. Prepare test and inspection reports.
G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

## 3.3 DEMONSTRATIONS

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

# SECTION 311000 - 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.

### 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. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Temporary erosion- and sedimentation-control measures.

B. Related Sections:

1. Refer to Civil Drawing for additional specifics.

### 1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically 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 and is the zone where plant roots grow.

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, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other 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.

1.5 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 videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT 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 traffic ways 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. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify utility locator service 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. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.

4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil 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. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Wrap a 1-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground.

C. 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. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

## 3.3 TREE AND PLANT PROTECTION

A. General: 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, in a manner approved by Architect.

## 3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

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 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.

## 3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

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 a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

## 3.6 TOPSOIL STRIPPING

A. Strip topsoil to depth indicated on Drawings in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.

2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

## 3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

## 3.8 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.

END OF SECTION 311000

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# SECTION 312000 - EARTH MOVING

## 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. Preparing subgrades for slabs-on-grade.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.

B. Related Sections:

1. Section 015000 "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
2. Section 033000 "Cast-in-Place Concrete" for granular course beneath the slab-on-grade.
3. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Section 023720 "Drilled Concrete Piers and Shafts" for excavation of shafts and disposal of surplus excavated material.

### 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 hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

G. Engineered Fill: Soil materials used to raise Building Excavation for slabs to required grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

## 1.4 SUBMITTALS

A. Material Test Reports: For each soil material proposed for engineered fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698.

## 1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

B. Preexcavation Conference: Conduct conference at Project site.

## 1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving 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 traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures are in place.

D. Do not commence earth moving operations until plant-protection measures are in place.

E. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.

6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

A. Reference Geotechnical Report by Brown Intertec – B1611833, dated January 27, 2107.

B. General: Provide borrow soil materials when/as satisfactory soil materials are not available from excavations.

C. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Plasticity Index: Greater than 2 but less than 15.

D. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within -1 to 3 percent of optimum moisture content at time of compaction.

E. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-inch sieve and not more than 12 percent passing a No. 200 sieve with a PI of less than 15 and greater than 2.

H. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

I. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a ¼ inch sieve and 0 to 5 percent passing a No. 8 sieve.

J. Sand: ASTM C 33; fine aggregate.

2.2 GEOTEXTILES

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 earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches or provide pumps to remove or prevent runoff water from accumulating.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate existing grade below the new structure to a level of 48” below drainage course and slab within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Over excavate grade beams to allow for void boxes. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.4 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and 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 the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or 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 projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, 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 or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

## 3.5 SUBGRADE INSPECTION

A. Notify Testing Lab when excavations have reached required Subgrade depth.

B. If Testing Lab determines that unsatisfactory soil is present, continue excavation and replace with compacted engineered or fill material as directed.

## 3.6 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

## 3.7 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.8 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.

3.9 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.10 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inchesin 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.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.11 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 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.

## 3.12 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage on prepared subgrade.
2. Place drainage course 4 inches thickness in a single layer.

## 3.13 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.14 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

# SECTION 313116 - TERMITE CONTROL

## 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. Soil treatment with termiticide.

### 1.3 SUBMITTALS

A. Product Data: For each type of termite control product.

1. Include the EPA-Registered Label for termiticide products.

B. Qualification Data: For qualified Installer.

C. Product Certificates: For termite control products, from manufacturer.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

E. Warranties: Sample of special warranties.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located, and who employs workers trained and approved by manufacturer to install manufacturer's products.

B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products from single manufacturer.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction, and before the installation of the Vapor Barrier. Do not apply more than 24 hours prior to installation of Vapor Barrier.

1.6 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

1. Products: Subject to compliance with requirements, provide the followingavailable products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Corporation, Agricultural Products; Termidor.
b. Bayer Environmental Science; Premise 75.
c. FMC Corporation, Agricultural Products Group; Dragnet FT.
d. Syngenta; Demon TC.

2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

3. Dye: Provide colored dye to termiticide solution in concentration to color the soil for verification of coverage.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

### 3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

### 3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116