CITY OF DES MOINES

PUBLIC IMPROVEMENTS
CONTRACT DOCUMENTS

DES MOINES FIRE STATION NO. 11
(VOLUME 1 of 2)

ACTIVITY ID
102019001

PLAN FILE NO.
601-070/209

CITY COUNCIL APPROVAL

APPROVAL DATE
December 16, 2019

ROLL CALL NO.

CONTRACT NO.

CONTRACTOR

CONTRACT AMOUNT
$.00

ENGINEERING DEPARTMENT
Steven L. Naber, P.E.
Des Moines City Engineer

Funding Information
Object Code    542010
Organization No. C041FR99
Project No.    FR041
The following documents are part of this contract:

Documents

Volume 1:

Instructions to Bidders
Official Publications
Proposal
Bid Bond
Contract
Performance, Payment and Maintenance Bond

Addenda:

Special Provisions:

  Bidding Requirements
  Contractual Requirements
  Technical Specifications – Section 00 00 00 – 22 40 00

Volume 2:

Technical Specifications – Section 23 05 00 – 33 49 00

Supplemental Specifications:

  General Supplemental Specifications to SUDAS, 2019 Edition
  Supplemental Specification for Tree Planting
  Supplemental Specification for Project Sign
  Supplemental Specification for Tree Protection

April 22, 2019
October 3, 2013
September 25, 2019
March 24, 2017

PROJECT ENGINEER: Timothy B. Brady, P.E.

Phone Number: (515) 283-4025
INSTRUCTIONS TO BIDDERS

Activity ID 10-2019-001
Project Name Des Moines Fire Station No. 11
Fed/St. Project No.

The work comprising the above referenced project shall be constructed in accordance with the SUDAS Standard Specifications, 2019 Edition; and as further modified by the supplemental specifications and special provisions included in the contract documents. The Des Moines City Engineer is the Engineer. The terms used in the contract documents are defined in said SUDAS Standard Specifications. The City of Des Moines is the Contracting Authority on this project and shall hereinafter be referred to as the "Jurisdiction". Before submitting your bid, please review the SUDAS Standard Specifications, in particular, Division 1 - General Provisions and Covenants, including the sections regarding proposal requirements, bonding, contract execution and insurance requirements. Please be certain that all documents have been properly completed and submit them to the City Clerk, 1st Floor, City Hall, 400 Robert D. Ray Drive, Des Moines, Iowa, 50309.

I. BID SECURITY

The bid security must be in the minimum amount of 10% of the total bid amount including all add alternates (do not deduct the amount of deduct-alternates). Bid security shall be as defined in Section 26.8 of the Iowa Code and shall be in the form of a cashier's check or certified check drawn on a state-chartered or federally chartered bank, or a certified share draft drawn on a state-chartered or federally chartered credit union, or a bid bond executed by a corporation authorized to contract as a surety in Iowa or satisfactory to the Jurisdiction. The bid bond must be submitted on the enclosed Bid Bond form (DSM Urban 04/20/98) as no other bid bond forms are acceptable. All signatures on the bid bond must be original signatures in ink; facsimile (fax) of any signature on the bid bond is not acceptable. Bid security other than said bid bond shall be made payable to the City of Des Moines. "Miscellaneous Bank Checks", and personal checks, as well as "Money Orders" and "Traveler's Checks" issued by persons, firms or corporations licensed under Chapter 533B of the Iowa Code, are not acceptable bid security. **NOTE: If the Bidder submits Bid Security in the form of a Bid Bond, and the Bidder wishes to have their Bid Bond returned to them after an approved contract and bond has been executed or after there is a rejection of all bids (in accordance with Iowa Code 26.10), the Bidder shall include a self-addressed envelope with the Bid Bond.**

II. SUBMISSION OF THE PROPOSAL AND IDENTITY OF BIDDER

A. The proposal shall be sealed in an envelope, properly identified as the Proposal with the project title and the name and address of the bidder, and deposited with the Jurisdiction at or before the time and at the place provided in the Notice to Bidders. It is the sole responsibility of the bidder to see that its proposal is delivered to the Jurisdiction prior to the time for opening bids, along with the appropriate bid security sealed in the separate envelope identified as Bid Security and attached to the outside of the bid proposal envelope. Any proposal received after the scheduled time for the receiving of proposals will be returned to the bidder unopened and will not be considered. Bidders must either utilize the two envelopes provided with the Bidding documents, or Bidders provide their own two envelopes, for their proposals and bid security for submission of their bids.

**Sales Tax:** The bidder should not include sales tax in the bid pursuant to Iowa Code. A sales tax exemption certificate will be available for all material purchased for incorporation in the project.

**Accessibility for individuals with disabilities.** The City of Des Moines is pleased to provide accommodations to individuals with disabilities or groups and encourages participation in City government. To better serve you, please notify us at least three business days in advance when possible at 515-283-4209, should special accommodations be required.
B. All pages of the Proposal must be returned. The following documents shall be completed, signed and returned in the Proposal envelope.

PROPOSAL - Complete each of the following parts:
- Part B - Acknowledgement of Addenda, if any have been issued;
- Part C - Bid Items, Quantities and Prices;
- Part F - Additional Requirements; The following proposal attachment documents must be completed and attached:

<table>
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<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION OF ATTACHMENT</th>
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<tr>
<td>1.</td>
<td>Reciprocal Resident Bidder and Labor Force</td>
</tr>
<tr>
<td>2.</td>
<td>General</td>
</tr>
</tbody>
</table>

- Part G - Identity of Bidder.

The Bidder shall sign the proposal. The signature on the proposal and all proposal attachments must be an original signature in ink signed by the same individual who is the Company Owner or an authorized Officer of the Company; copies or facsimile of any signature will not be accepted. The Bidder Status Form (PROPOSAL Part F Item 2B), is required by the Iowa Labor Commissioner, pursuant to Iowa Admin. Code rule 875-156.2(1). The Bidder must complete and submit the Bidder Status Form, signed by an authorized representative of the Bidder, with their bid proposal. Under Iowa Admin. Code rule 875-156.2(1), failure to provide the Bidder Status Form with the bid may result in the bid being deemed non-responsive and may result in the bid being rejected. The Worksheet: Authorization to Transact Business from the Labor Commissioner is included on page 3 of 3 of the Instructions to Bidders, to assist Bidders in completing the Bidder Status Form.

C. Out-of-State Contractors:

1. Pursuant to Section 91C.7 of the Iowa Code, an out-of-state contractor, before commencing a contract in excess of five thousand dollars in value in Iowa, shall file a bond with the Division of Labor Services of the Iowa Department of Workforce Development. The contractor should contact 515-242-5871 for further information. Prior to contract execution, the City Engineer may forward a copy of this contract to the Iowa Department of Workforce Development as notification of pending construction work. It is the contractor's responsibility to comply with said Section 91C.7 before commencing this work.

2. Prior to entering into contract, the designated low bidder, if it be a corporation organized under the laws of a state other than Iowa, shall file with the Engineer a certificate from the Secretary of the State of Iowa showing that it has complied with all the provisions of Chapter 490 of the Code of Iowa, or as amended, governing foreign corporations. For further information contact the Iowa Secretary of State Office at 515-281-5204.

III. GENERAL

A. All bid documents must be submitted as printed. No alterations, additions, or deletions are permitted. If the Bidder notes a requirement in the contract documents that the Bidder believes will require a conditioned or unsolicited alternate bid, the Bidder must immediately notify the Engineer in writing. The Engineer will issue any necessary interpretation by an addendum.

B. Additional information regarding addenda, plan holders, bid tabulations, etc. can be found on the Engineering Department web site at <http://www.dmgov.org/Departments/Engineering/Pages/BidsContracts.aspx>.
Worksheet: Authorization to Transact Business

This worksheet may be used to help complete Part A of the Resident Bidder Status Form. If at least one of the following describes your business, you are authorized to transact business in Iowa.

Yes ___ No ___ My business is currently registered as a contractor with the Iowa Division of Labor.

Yes ___ No ___ My business is a sole proprietorship and I am an Iowa resident for Iowa income tax purposes.

Yes ___ No ___ My business is a general partnership or joint venture. More than 50 percent of the general partners or joint venture parties are residents of Iowa for Iowa income tax purposes.

Yes ___ No ___ My business is an active corporation with the Iowa Secretary of State and has paid all fees required by the Secretary of State, has filed its most recent biennial report, and has not filed articles of dissolution.

Yes ___ No ___ My business is a corporation whose articles of incorporation are filed in a state other than Iowa, the corporation has received a certificate of authority from the Iowa secretary of state, has filed its most recent biennial report with the secretary of state, and has neither received a certificate of withdrawal from the secretary of state nor had its authority revoked.

Yes ___ No ___ My business is a limited liability partnership which has filed a statement of qualification in this state and the statement has not been canceled.

Yes ___ No ___ My business is a limited liability partnership which has filed a statement of qualification in a state other than Iowa, has filed a statement of foreign qualification in Iowa and a statement of cancellation has not been filed.

Yes ___ No ___ My business is a limited partnership or limited liability limited partnership which has filed a certificate of limited partnership in this state, and has not filed a statement of termination.

Yes ___ No ___ My business is a limited partnership or a limited liability limited partnership whose certificate of limited partnership is filed in a state other than Iowa, the limited partnership or limited liability limited partnership has received notification from the Iowa secretary of state that the application for certificate of authority has been approved and no notice of cancellation has been filed by the limited partnership or the limited liability limited partnership.

Yes ___ No ___ My business is a limited liability company whose certificate of organization is filed in Iowa and has not filed a statement of termination.

Yes ___ No ___ My business is a limited liability company whose certificate of organization is filed in a state other than Iowa, has received a certificate of authority to transact business in Iowa and the certificate has not been revoked or canceled.
NOTICE TO BIDDERS

CITY OF DES MOINES PUBLIC IMPROVEMENT PROJECT

Time and Place for Filing Sealed Proposals. Sealed bids for the work comprising each improvement as stated below must be filed at or before 11:00 a.m. on December 3, 2019, in the office of the City Clerk, 1st Floor, City Hall, 400 Robert D. Ray Drive, Des Moines, Iowa, 50309.

Accessibility for individuals with disabilities. The City of Des Moines is pleased to provide accommodations to individuals with disabilities or groups and encourages participation in City government. To better serve you, please notify us at least three business days in advance when possible at 515-283-4209, should special accommodations be required.

Time and Place Sealed Proposals Will be Opened and Considered. Sealed proposals will be opened and bids tabulated at 11:00 a.m., on December 3, 2019, in the City Council Chambers, 2nd Floor, City Hall, 400 Robert D. Ray Drive, Des Moines, Iowa, for consideration by the City Council (Council) at its meeting on December 16, 2019. The City of Des Moines (Jurisdiction) reserves the right to reject any and all bids.

Time for Commencement and Completion of Work. Work on each improvement shall be commenced upon approval of the contract by the Council, and completed as stated below.

Bid Security. Each bidder shall accompany its bid with bid security as defined in Section 26.8 of the Iowa Code and as specified by the Jurisdiction.

Contract Documents. Copies of the contract documents will be available after November 04, 2019, from the City Engineer’s Office, 2nd Floor, City Hall, 400 Robert D. Ray Drive, Des Moines, Iowa 50309, at no cost, phone (515) 283-4573.

Preference for Iowa Products and Labor. By virtue of statutory authority, preference will be given to products and provisions grown and coal produced within the State of Iowa, and to Iowa domestic labor, to the extent lawfully required under Iowa statutes.

Sales Tax. The bidder should not include sales tax in the bid. A sales tax exemption certificate will be available for all material purchased for incorporation in the project.

General Nature of Public Improvement.
Des Moines Fire Station No. 11, 10-2019-001
The improvement includes new construction of an approximately 14,600 square feet fire station which includes a two-story mechanical area, living quarters, and a three bay apparatus area; design consists of cast stone, brick masonry, glazed aluminum curtainwall and architectural aluminum metal panels; wall structure consists of perimeter bearing walls and internal bearing and non-bearing concrete masonry units; floor structure is steel beam framing and concrete/metal floor decking; roof structure is metal roof joists and decking; roofing system is a single-ply, fully adhered membrane on low slope roof areas and metal roof for the apparatus bay; also sidewalks, utilities and reconstruction of E. 42nd Street; all work in accordance with the contract documents, including Plan File Nos. 601-070/209, located at 4150 E. 42nd Street, Des Moines, Iowa.

This project shall be fully completed not later than June 30, 2021.

Engineer’s Construction Estimate. $4,900,000.00

Preletting Conference. A preletting conference will be held at 2:00 p.m. on November 20, 2019, in the St. Etienne Conference Room, Armory Building (lower level), 602 Robert D. Ray Dr., Des Moines, Iowa.
NOTICE OF PUBLIC HEARING
CITY OF DES MOINES PUBLIC IMPROVEMENT PROJECT

Public Hearing on Proposed Contract Documents and Estimated Costs for Improvement. A public hearing will be held by the City Council on the proposed contract documents (plans, specifications and form of contract) on file in the City Engineer’s Office, and estimated cost for each improvement at its meeting on December 16, 2019, at 5:00 p.m., in the City Council Chambers, 2nd Floor, City Hall, 400 Robert D. Ray Drive, Des Moines, Iowa. The City Council Meetings are open to all individuals regardless of disability. To better serve you, please notify the City Clerk at least three business days in advance, when possible, should special accommodations be required.

General Nature of Public Improvement

Des Moines Fire Station No. 11, 10-2019-001
The improvement includes new construction of an approximately 14,600 square feet fire station which includes a two-story mechanical area, living quarters, and a three bay apparatus area; design consists of cast stone, brick masonry, glazed aluminum curtainwall and architectural aluminum metal panels; wall structure consists of perimeter bearing walls and internal bearing and non-bearing concrete masonry units; floor structure is steel beam framing and concrete/metal floor decking; roof structure is metal roof joists and decking; roofing system is a single-ply, fully adhered membrane on low slope roof areas and metal roof for the apparatus bay; also sidewalks, utilities and reconstruction of E. 42nd Street; all work in accordance with the contract documents, including Plan File Nos. 601-070/209, located at 4150 E. 42nd Street, Des Moines, Iowa

Published in the Des Moines Register
November 27, 2019
PUBLIC NOTICE OF STORM WATER DISCHARGE

The City of Des Moines, or its Contractor for the following work, plans to submit a Notice of Intent to the Iowa Department of Natural Resources to be covered under NPDES General Permit No. 2 "Storm Water Discharge Associated with Industrial Activity for Construction Activities." The storm water discharge will be from the construction of the Des Moines Fire Station No. 11 Activity ID 10-2019-001, located in Sec. 21, T79N, R23W, Polk County.

Storm water will be discharged from 1 point source and will be discharged to the following stream: Four Mile Creek/Des Moines River.

Comments may be submitted to the Storm Water Discharge Coordinator, IOWA DEPARTMENT OF NATURAL RESOURCES, Environmental Protection Division, 502 E. 9th Street, Des Moines, IA, 50319-0034. The public may review the Notice of Intent from 8:00 a.m. to 4:30 p.m., Monday through Friday, at the above address after it has been received by the department.

Published in the Des Moines Register
November 6, 2019
PROPOSAL

To the Honorable Mayor and Members of the
City Council, City of Des Moines, Iowa

PROPOSAL: PART A - SCOPE

The City of Des Moines, hereinafter called the "Jurisdiction", has need of a qualified contractor to complete the work comprising the below referenced improvement. The undersigned Bidder hereby proposes to complete the work comprising the below referenced improvements or project as specified in the contract documents, which are officially on file with the Jurisdiction, in the Des Moines City Engineer's Office, at the prices hereinafter provided in Part C of this Proposal, for the following described improvements:

Des Moines Fire Station No. 11, 10-2019-001

The improvement includes new construction of an approximately 14,600 square feet fire station which includes a two-story mechanical area, living quarters, and a three bay apparatus area; design consists of cast stone, brick masonry, glazed aluminum curtainwall and architectural aluminum metal panels; wall structure consists of perimeter bearing walls and internal bearing and non-bearing concrete masonry units; floor structure is steel beam framing and concrete/metal floor decking; roof structure is metal roof joists and decking; roofing system is a single-ply, fully adhered membrane on low slope roof areas and metal roof for the apparatus bay; also sidewalks, utilities and reconstruction of E. 42nd Street; all work in accordance with the contract documents, including Plan File Nos. 601-070/209, located at 4150 E. 42nd Street, Des Moines, Iowa

PROPOSAL: PART B - ACKNOWLEDGEMENT OF ADDENDA

The Bidder hereby acknowledges that all addenda become a part of the contract documents when issued, and that each such addendum has been received and utilized in the preparation of this bid. The Bidder hereby acknowledges receipt of the following addenda by inserting the number of each addendum in the blanks below:

ADDENDUM NUMBER __________ ADDENDUM NUMBER __________
ADDENDUM NUMBER __________ ADDENDUM NUMBER __________

and certifies that said addenda were utilized in the preparation of this bid.
PROPOSAL: PART C - BID ITEMS, QUANTITIES AND PRICES

UNIT BID PRICE CONTRACTS: The bidder must provide all unit prices, the amount, the total construction cost, any alternate price(s), and the total construction cost plus any add-alternates if there are alternates on the proposal on Proposal Attachment: Part C - Bid Items, Quantities, and Prices. The total construction cost plus any alternates selected by the Jurisdiction shall be used for comparison of bids. The total construction cost plus any add-alternates shall be used for determining the sufficiency of the bid security.

BASE BID CONTRACTS: The bidder must provide any bid price(s), the total base bid price, any alternate price(s), and the total base bid plus any add-alternates if there are alternates on the proposal on Proposal Attachment: Part C - Bid Items, Quantities, and Prices. The total base bid plus any alternates selected by the Jurisdiction shall be used for comparison of bids. The total base bid plus any add-alternates shall be used for determining the sufficiency of the bid security.

PROPOSAL: PART D - GENERAL

The Bidder hereby acknowledges that the Jurisdiction, in advertising for public bids for this project, reserves the right to:

1. Reject any or all bids. Award of the contract, if any, to be to the lowest responsible, responsive bidder; and

2. Reject any or all alternates in determining the items to be included in the contract. Designation of the lowest responsible, responsive bidder to be based on comparison of the total bid plus any selected alternates; and

3. Make such alterations in the contract documents or in the proposal quantities as it determines necessary in accordance with the contract documents after execution of the contract. Such alterations shall not be considered a waiver of any conditions of the contract documents, and shall not invalidate any of the provisions thereof; and

The Bidder hereby agrees to:

1. Enter into a contract, if this proposal is selected, in the form approved by the Jurisdiction and provide the following documents:
   - Proof of registration with the Iowa Division of Labor in accordance with Chapter 91C of the Iowa Code by providing a valid Registration Number,
   - Proof of insurance by a Certificate(s) of Insurance,
   - A performance, maintenance, and payment bond; and

2. Forfeit bid security, not as a penalty but as liquidated damages, upon failure to enter into such contract and/or to furnish said documents and information as requested in Item 1 above acceptable to the Des Moines City Engineer; and

3. Commence the work on this project on or before a date to be specified in a written notice to proceed by the Jurisdiction, and to fully complete the project not later than June 30, 2021; and to pay liquidated damages for noncompliance with said completion provisions at the rate of five hundred and 00/100 dollars ($500.00) for each calendar day thereafter that the work remains incomplete.
PROPOSAL: PART E - NON-COLLUSION AFFIDAVIT

The Bidder hereby certifies:

1. That this proposal is not affected by, contingent on, or dependent on any other proposal submitted for any improvement with the Jurisdiction; and

2. That no individual employed by the Bidder has employed any person to solicit or procure the work on this project, nor will any employee of the Bidder make any payment or agreement for payment of any compensation in connection with the procurement of this project; and

3. That no part of the bid price received by the Bidder was paid or will be paid to any person, corporation, firm, association, or other organization for soliciting the bid, other than the payment of their normal compensation to persons regularly employed by the Bidder whose services in connection with the construction of the project were in the regular course of their duties for the Bidder; and

4. That this proposal is genuine and not collusive or sham; that the Bidder has not colluded, conspired, connived or agreed, directly or indirectly, with any bidder or person, to put in a sham bid or to refrain from bidding, and has not in any manner, directly or indirectly, sought, by agreement or collusion, or communication or conference, with any person, to fix the bid price of the Bidder or of any other bidder, and that all statements in this proposal are true; and

5. That the individual(s) executing this proposal have the authority to execute this proposal on behalf of the Bidder.

PROPOSAL: PART F - ADDITIONAL REQUIREMENTS

The Bidder hereby agrees to comply with the additional requirements listed below, which are included in this proposal and identified as proposal attachments:

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PROPOSAL: PART G - IDENTITY OF BIDDER

The Bidder shall indicate whether the bid is submitted by a/an

☐ Individual, Sole Proprietorship

☐ Partnership

☐ Corporation

☐ Limited Liability Company

☐ Joint-venture: all parties must join-in and execute all documents

☐ Other ____________________________

________________________________________________________________________

Bidder

By ____________________________

Signature

Name (Print/Type)

Title

Street Address

City, State, Zip Code

Telephone Number / Email Address

A contract will not be executed until the apparent low Bidder is registered with the Iowa Commissioner of Labor pursuant to Section 91C.5 of the Iowa Code. The Bidder should contact 515-242-5871 for registration information.

Engineering Department Staff will contact the apparent low Bidder and obtain the name and title of the company's owner, president, CEO, etc. if a different person than entered above.

NOTE: The signature on this proposal must be an original signature in ink; copies or facsimile of any signature will not be accepted.
This is a base bid price contract. The bidder must provide any bid price(s), the total base bid price, any alternate price(s), and the total base bid plus any add-alternates if there are alternates on the proposal. The total base bid plus any alternates selected by the Jurisdiction shall be used for comparison of bids. The total base bid plus any add-alternates shall be used for determining the sufficiency of the bid security.

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<th>AMOUNT</th>
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<tbody>
<tr>
<td>1</td>
<td>As described in Contract Documents, Fire Station No. 11, complete as specified. Plan sheets G000-P501</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>As described in Contract Documents, E. 42 Street Roadway Improvements, complete as specified. Plan sheets A.1-W.2</td>
<td></td>
</tr>
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</table>

TOTAL BASE BID

Activity ID: 10-2019-001
IDOT Project No.: None
PROPOSAL ATTACHMENT: PART F - ADDITIONAL REQUIREMENTS

ITEM 1 - RECIPROCAL RESIDENT BIDDER AND LABOR FORCE

Iowa Code section 73A.21 provides for a Reciprocal Resident Bidder and Labor Force preference.

Because of the nature of this project (i.e. Federal-aid participation), the Reciprocal Resident Bidder and Labor Force preference,

☐ shall not apply to this project, and the bidder need not complete the Resident Bidder Information below.

☒ shall apply to this project, and the bidder shall complete the Resident Bidder Information below.

To implement section 73A.21, the Iowa Labor Commissioner adopted chapter 156 of the Iowa Administrative Code, “Bidder Preferences in Government Contracting”. Iowa Admin. Code rule 875-156.2(1) requires each bidder to complete the attached Bidder Status Form. The Bidder must complete and submit the Bidder Status Form, signed by an authorized representative of the bidder, with their bid Proposal. Under Iowa Admin. Code rule 875-156.2(1), failure to provide the statement with the bid may result in the bid being deemed nonresponsive and may result in the bid being rejected.
Bidder Status Form

To be completed by all bidders

Part A

Please answer "Yes" or "No" for each of the following:

Yes____ No____ My company is authorized to transact business in Iowa.
(To help you determine if your company is authorized, please review the "Worksheet: Authorization to Transact Business", on page 3 of the "Instructions to Bidders".)

Yes____ No____ My company has an office to transact business in Iowa.

Yes____ No____ My company's office in Iowa is suitable for more than receiving mail, telephone calls, and e-mail.

Yes____ No____ My company has been conducting business in Iowa for at least 3 years prior to the first request for bids on this project.

Yes____ No____ My company is not a subsidiary of another business entity or my company is a subsidiary of another business entity that would qualify as a resident bidder in Iowa.

If you answered "Yes" for each question above, your company qualifies as a resident bidder. Please complete Parts B and D of this form.

If you answered "No" to one or more questions above, your company is a nonresident bidder. Please complete Parts C and D of this form.

To be completed by resident bidders

Part B

My company has maintained offices in Iowa during the past 3 years at the following addresses:

Dates: ______ / ______ / ______ to ______ / ______ / ______ Address: ________________________________

City, State, Zip: ________________________________

Dates: ______ / ______ / ______ to ______ / ______ / ______ Address: ________________________________

City, State, Zip: ________________________________

Dates: ______ / ______ / ______ to ______ / ______ / ______ Address: ________________________________

City, State, Zip: ________________________________

You may attach additional sheet(s) if needed.

To be completed by non-resident bidders

Part C

1. Name of home state or foreign country reported to the Iowa Secretary of State:

2. Does your company's home state or foreign country offer preferences to bidders who are residents? Yes____ No____

3. If you answered "Yes" to question 2, identify each preference offered by your company's home state or foreign country and the appropriate legal citation.

You may attach additional sheet(s) if needed.

To be completed by all bidders

Part D

I certify that the statements made on this document are true and complete to the best of my knowledge and I know that my failure to provide accurate and truthful information may be a reason to reject my bid.

Firm Name:

Signature: ___________________________ Date: ___________________________

You must submit the completed form to the governmental body requesting bids per 875 Iowa Administrative Code Chapter 156.

This form has been approved by the Iowa Labor Commissioner.

309-6001 02-14

PROPOSAL ATTACHMENT: PART F: Page 2 of 3 Pages
PROPOSAL ATTACHMENT: PART F - ADDITIONAL REQUIREMENTS
ITEM 2 - GENERAL

1. The work under this proposal shall be constructed in accordance with the SUDAS Standard Specifications, 2019 Edition, and as further modified by the supplemental specifications and special provisions included in the contract documents.

Alternate Sales Tax:
Section 1020, 1.08, B, of the Supplemental Specifications shall apply. The bidder should not include sales tax in the bid. A sales tax exemption certificate will be available for all material purchased for incorporation in the project.

2. The Bidder hereby acknowledges that the City of Des Moines in advertising for public bids for this work reserves the right to give a limited notice to proceed of a duration not longer than three months. This limited notice to proceed shall be given where all necessary right-of-way has not yet been acquired. The limited notice to proceed will allow construction to proceed as far as possible and practical on the right-of-way, which has been acquired.

3. The Bidder hereby acknowledged and agrees:
   - To comply with the Equal Employment Opportunity Program included in the City of Des Moines Contract Compliance Program, which is available at the following website <http://www.dmgov.org/Departments/Engineering/PDF/Contract%20Compliance%20Program%20(June%202017).pdf>
     or from the City Engineer's Office.
   - To comply with any and all applicable provisions of the Des Moines Human Rights Ordinance, Chapter 62, of the Des Moines Municipal Code.
   - Not to discriminate against any employees, or applicants for employment, on the basis of age, race, religion, creed, color, sex, sexual orientation, national origin, ancestry, disability, familial status or gender identity.

4. The City's Overall Annual DBE/TSB Goal for calendar year 2019 is 5.94%, which represents a target that the City would like to achieve in including DBE/TSB participation on City contracts; and is not a mandatory goal for this project. The Certified Directory of DBEs is available at the following website <https://secure.iowadot.gov/DBE/Directory/Index/>. The Certified Directory of TSBs is available at the following website <https://iowaeda.dynamics365portals.us/tsb-search/>
KNOW ALL BY THESE PRESENTS

That we, __________________________________________, as Principal, and
____________________________________________________, as Surety, are held and firmly
bound unto the City of Des Moines, as Obligee (hereinafter the "Jurisdiction"), in the penal sum of

_____________________________________________dollars

($______________) lawful money of the United States, for which payment the Principal and Surety bind
themselves, their heirs, executors, administrators, successors, and assigns jointly and severally, firmly by
these presents.

The Principal has submitted to the Jurisdiction a proposal to enter into a contract in writing, for the following
described improvements:

Des Moines Fire Station No. 11, 10-2019-001
The improvement includes new construction of an approximately 14,600 square feet fire station which
includes a two-story mechanical area, living quarters, and a three bay apparatus area; design consists of cast
stone, brick masonry, glazed aluminum curtainwall and architectural aluminum metal panels; wall structure
consists of perimeter bearing walls and internal bearing and non-bearing concrete masonry units; floor
structure is steel beam framing and concrete/metal floor decking; roof structure is metal roof joists and
decking; roofing system is a single-ply, fully adhered membrane on low slope roof areas and metal roof for
the apparatus bay; also sidewalks, utilities and reconstruction of E. 42nd Street; all work in accordance with
the contract documents, including Plan File Nos. 601-070/209, located at 4150 E. 42nd Street, Des Moines,
Iowa

The Surety hereby stipulates and agrees that the obligations of the Surety and its Bond will be in no way impaired
or affected by any extension of the time within which the Jurisdiction may accept the Bid or execute a Contract;
and the Surety does hereby waive notice of any such extension.

In the event that any actions or proceedings are initiated with respect to this Bond, the parties agree that the
venue will be Polk County, State of Iowa. If legal action is required by the Jurisdiction against the Surety or
Principal to enforce the provisions of this bond or to collect the monetary obligation accruing to the benefit of the
Jurisdiction, the Surety or Principal agrees to pay the Jurisdiction all outlay and expense incurred by the
Jurisdiction in enforcing any of the provisions of this Bond. All rights, powers, and remedies of the Jurisdiction
are cumulative and not alternative and are in addition to all rights, powers and remedies given to the Jurisdiction
by law. The Jurisdiction may proceed against the Surety for any amount guaranteed hereunder whether action is
brought against Principal or whether or not the Principal is joined in the action. As used herein, the phrase "all
outlay and expense" is not to be limited in any way, but includes the actual and reasonable costs and expenses
incurred by the Jurisdiction including interest, benefits and overhead where applicable. Accordingly, "all outlay
and expense" would include but not be limited to all contract or employee expense, outside experts, attorneys
fees (including overhead expenses of the Jurisdiction's staff attorneys), and all costs and expenses of litigation as
they are incurred by the Jurisdiction.
If the proposal by the Principal is accepted and the Principal enters into a contract with the Jurisdiction in accordance with the terms of the proposal, including the provision of insurance and bond as specified in the contract documents with good and sufficient surety for the faithful performance of the contract, for the prompt payment of labor and material furnished in the prosecution of the work, and for the maintenance of the improvements as may be required in the contract documents or, in the event the Principal does not enter into a contract and provide the required insurance and bonds, the Principal pays the penal sum to the Jurisdiction, then this obligation will become null and void; otherwise, the Surety shall pay to the Jurisdiction the full amount of the bid bond, together with court costs, attorney’s fees, and any other expense of recovery.

Signed and sealed this __________ day of ________________________, 20________

SURETY:

Surety Company

By ____________________________
Signature Attorney-in-Fact/Officer

Name of Attorney-in-Fact/Officer

Company Name

Company Address

City, State Zip Code

Company Telephone Number

PRINCIPAL:

Bidder

By ____________________________
Signature

Name

Title

Address

City, State Zip Code

Telephone Number

NOTE:

1. All signatures on this bid bond must be original signatures in ink; copies or facsimile of any signature will not be accepted.

2. This bond must be sealed with the Surety's raised, embossed seal.

3. The Certificate or Power of Attorney accompanying this bond must be valid on its face and sealed with the Surety’s raised, embossing seal, or security watermark.

4. The name and signature of the Surety’s Attorney-in-Fact/Officer entered on this bond must be exactly as listed on the Certificate or Power of Attorney accompanying this bond.
CONTRACT

THIS CONTRACT, made and entered into at Des Moines, Iowa, on ______________________, by and between the City of Des Moines, by its Mayor, upon order of its City Council, hereinafter the "Jurisdiction", and ______________________, hereinafter the "Contractor".

WITNESSETH:

The Contractor hereby agrees to complete the work comprising the below referenced improvement as specified in the contract documents, which are officially on file with the Jurisdiction, in the Des Moines City Engineer's Office. This contract includes all contract documents. The work under this contract shall be constructed in accordance with the SUDAS Standard Specifications, 2019 Edition; and as further modified by the supplemental specifications and special provisions included in said contract documents, and the Contract Attachments attached hereto. The Des Moines City Engineer is the Engineer. The Contractor further agrees to complete the work in strict accordance with said contract documents, and to guarantee the work as required by law, for the time required in said contract documents, after its acceptance by the Jurisdiction.

This contract is awarded and executed for completion of the work specified in the contract documents for the bid prices shown on the Contract Attachment: Item 2: Bid Items, Quantities and Prices which were proposed by the Contractor in its proposal submitted in accordance with the Notice to Bidders for the following described improvements:

Des Moines Fire Station No. 11, 10-2019-001
The improvement includes new construction of an approximately 14,600 square feet fire station which includes a two-story mechanical area, living quarters, and a three bay apparatus area; design consists of cast stone, brick masonry, glazed aluminum curtainwall and architectural aluminum metal panels; wall structure consists of perimeter bearing walls and internal bearing and non-bearing concrete masonry units; floor structure is steel beam framing and concrete/metal floor decking; roof structure is metal roof joists and decking; roofing system is a single-ply, fully adhered membrane on low slope roof areas and metal roof for the apparatus bay; also sidewalks, utilities and reconstruction of E. 42nd Street; all work in accordance with the contract documents, including Plan File Nos. 601-070/209, located at 4150 E. 42nd Street, Des Moines, Iowa.

The Contractor agrees to perform said work for and in consideration of the Jurisdiction's payment of the bid amount of ______________________ dollars ($ ______________________) which amount shall constitute the required amount of the performance, payment, and maintenance bond. The Contractor hereby agrees to commence work under this contract on or before a date to be specified in a written notice to proceed by the Jurisdiction and to fully complete the project not later than June 30, 2021; and to pay liquidated damages for noncompliance with said completion provisions in the amount of five hundred and 00/100 dollars ($500.00), for each calendar day thereafter that the work remains incomplete.
IN WITNESS WHEREOF, the Parties hereto have executed this instrument, in triplicate on the date first shown written.

<table>
<thead>
<tr>
<th>JURISDICTION:</th>
<th>CONTRACTOR:</th>
</tr>
</thead>
<tbody>
<tr>
<td>By</td>
<td></td>
</tr>
<tr>
<td>T. M. Franklin Cownie, Mayor</td>
<td></td>
</tr>
<tr>
<td>(Seal)</td>
<td>Contractor</td>
</tr>
<tr>
<td>ATTEST:</td>
<td></td>
</tr>
<tr>
<td>P. Kay Cmelik, City Clerk</td>
<td></td>
</tr>
</tbody>
</table>

FORM APPROVED BY:

Kathleen Vanderpool, Deputy City Attorney

CONTRACTOR PUBLIC REGISTRATION INFORMATION To Be Provided By:

1. **All Contractors:** The Contractor's Public Registration Number, issued by the Iowa Commissioner of Labor pursuant to Section 91C.5 of the Iowa Code, is as follows: Number

2. **Out-of-State Contractors:**

   A. **Pursuant to Section 91C.7 of the Iowa Code,** an out-of-state contractor, before commencing a contract in excess of five thousand dollars in value in Iowa, shall file a bond with the division of labor services of the department of workforce development. The contractor should contact 515-242-5871 for further information. Prior to contract execution, the City Engineer may forward a copy of this contract to the Iowa Department of Workforce Development as notification of pending construction work. It is the contractor's responsibility to comply with said Section 91C.7 before commencing this work.

   B. **Prior to entering into contract,** the designated low bidder, if it be a corporation organized under the laws of a state other than Iowa, shall file with the Engineer a certificate from the Secretary of the State of Iowa showing that it has complied with all the provisions of Chapter 490 of the Code of Iowa, or as amended, governing foreign corporations. For further information contact the Iowa Secretary of State Office at 515-281-5204.

**NOTE:** All signatures on this contract must be original signatures in ink; copies or facsimile of any signature will not be accepted.
CORPORATE ACKNOWLEDGEMENT

State of ____________________________ )
__________________________ ) SS
__________________________ County )

On this ____________ day of ____________, 20__________, before me, the undersigned, a Notary Public in and for the State of ____________, personally appeared ___________________________ and ___________________________, to me known, who, being by me duly sworn, did say that they are the ___________________________ and ___________________________, respectively, of the corporation executing the foregoing instrument; that (no seal has been procured by) (the seal affixed thereto is the seal of) the corporation; that said instrument was signed (and sealed) on behalf of the corporation by authority of this Board of Directors; that ___________________________ acknowledged the execution of the instrument to be the voluntary act and deed of the corporation, by it and by them voluntarily executed.

________________________________________
Notary Public in and for the State of ___________________________

My commission expires ___________________________
1. The Contractor acknowledges and agrees:
   - To comply with the Equal Employment Opportunity Program included in the City of Des Moines Contract Compliance Program, which is available at the following website <http://www.dmgov.org/Departments/Engineering/PDF/Contract%20Compliance%20Program%20(June%202017).pdf> or from the City Engineer’s Office.
   - To comply with any and all applicable provisions of the Des Moines Human Rights Ordinance, Chapter 62, of the Des Moines Municipal Code.
   - Not to discriminate against any employees, or applicants for employment, on the basis of age, race, religion, creed, color, sex, sexual orientation, national origin, ancestry, disability, familial status or gender identity.
   - To include this provision in all subcontracts for this project.

2. The Contractor agrees to comply with the requirements of the City of Des Moines Contract Compliance Program as referenced in the proposal. Final acceptance of the project will not be made until the Contractor has submitted to the City Engineer a notarized summary of payments to and scope of work by all DBE/TSB subcontractors.

3. The City of Des Moines Master Construction Safety Packet (Safety Plan) is available at <http://www.dmgov.org/Departments/Engineering/PDF/MasterConstructionSafetyPacket.pdf> and is also available upon request from the Engineering Department. The Engineering Department will make available a copy of the City of Des Moines Safety Plan to the Contractor when the contract is awarded. The Contractor understands and agrees that said Safety Plan is for the Contractor’s information only and that it is the Contractor’s sole responsibility to provide, or make available, this safety information to all its Subcontractors.

4. The Contractor understands and agrees that the construction of the work included in this contract is by its nature dangerous work. The Contractor agrees:
   - That the Contractor should have a safety program; however, the Contractor need not submit a safety program to the City of Des Moines, and City of Des Moines staff will not review or approve the Contractor’s safety program. The City of Des Moines assumes that the Contractor will maintain a safe worksite; however, City of Des Moines staff will not intrude in the Contractor’s responsibility for safety issues.
   - That until the work is accepted by the Jurisdiction; the work shall be in the custody of and under the charge, care, and control of the Contractor.
   - That the Contractor is responsible for the project area or work site.
   - That the Contractor is solely responsible for the safety of everyone on its work site.
   - That it is the Contractor’s sole responsibility to provide as safe a working site as possible given the nature of the work.
   - That it is the Contractor’s responsibility to notify and advise its employees, subcontractors, suppliers, and everyone on the worksite of the dangers associated with the work, and provide them with appropriate safety information to protect them from those dangers.
5. The Contractor acknowledges and agrees that no contract shall be binding upon the City of Des Moines until said contract has been executed by the Bidder, and shall have been approved by the City Council and executed by the Mayor and attested to by the City Clerk.

6. The Contractor agrees that sixty (60) days shall constitute a reasonable time within which it shall be required to make progress payments or final payment to subcontractors after each subcontractor's satisfactory performance of its work, all as required by Section 573.12 2.b.(2) of the Code of Iowa.
CONTRACT ATTACHMENT: ITEM 2 - BID ITEMS, QUANTITIES AND PRICES: 1 of 1

This contract is awarded and executed for completion of the work specified in the contract documents for the bid price tabulated below as proposed by the contractor in its proposal submitted in accordance with notice to bidders and notice of public hearing.

Activity ID: 10-2019-001
IDOT Project No.: None

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>As described in Contract Documents, Fire Station No. 11, complete as specified. Plan sheets G000-P501</td>
<td>1 LS</td>
</tr>
<tr>
<td>2</td>
<td>As described in Contract Documents, E. 42 Street Roadway Improvements, complete as specified. Plan sheets A.1-W.2</td>
<td>1 LS</td>
</tr>
</tbody>
</table>

TOTAL BASE BID

FOR INFORMATION ONLY
Performance, Payment & Maintenance Bond

Know all by these presents

That we, ____________________________, as Principal (the "Contractor" or "Principal"), and ____________________________, as Surety, are held and firmly bound unto the City of Des Moines, as Obligee (the "Jurisdiction"), and to all persons who may be injured by any breach of any of the conditions of this Bond

in the penal sum of ____________________________ dollars ($ ____________________________), lawful money of the United States, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, legal representatives and assigns, jointly and severally, firmly by these presents.

The conditions of the above obligations are such that whereas the Contractor entered into a contract with the Jurisdiction, bearing the date of ____________________________, (the "Contract") wherein the Contractor undertakes and agrees to construct the following described improvements:

Des Moines Fire Station No. 11, 10-2019-001

The improvement includes new construction of an approximately 14,600 square feet fire station which includes a two-story mechanical area, living quarters, and a three bay apparatus area; design consists of cast stone, brick masonry, glazed aluminum curtainwall and architectural aluminum metal panels; wall structure consists of perimeter bearing walls and internal bearing and non-bearing concrete masonry units; floor structure is steel beam framing and concrete/metal floor decking; roof structure is metal roof joists and decking; roofing system is a single-ply, fully adhered membrane on low slope roof areas and metal roof for the apparatus bay; also sidewalks, utilities and reconstruction of E. 42nd Street; all work in accordance with the contract documents, including Plan File Nos. 601-070/209, located at 4150 E. 42nd Street, Des Moines, Iowa

and to faithfully perform all the terms and requirements of the Contract within the time specified, in a good and workmanlike manner, and in accordance with the Contract Documents. Provided however, that one year after the date of acceptance by the Jurisdiction as complete, of the work under the above referenced Contract, the maintenance portion of this Bond shall continue in force but the penal sum for maintenance shall be reduced to ____________________________ dollars ($ ____________________________), which is the cost associated with those items shown on the Proposal and in the Contract which require a maintenance bond period in excess of one year.

It is expressly understood and agreed by the Contractor and Surety that the following provisions are a part of this Bond and are binding upon the Contractor and Surety, to-wit:

1. PERFORMANCE: The Contractor shall well and faithfully observe, perform, fulfill and abide by each and every covenant, condition and part of the Contract and Contract Documents, by reference made a part hereof, and shall indemnify and save harmless the Jurisdiction from all outlay and expense incurred by the Jurisdiction by reason of the Contractor's default or failure to perform as required. The Contractor shall also be responsible for the default or failure to perform as required under the Contract and Contract Documents by all its subcontractors, suppliers, agents, or employees furnishing materials or providing labor in the performance of the Contract.
2. PAYMENT: The Contractor and Surety on this bond hereby agree to pay all just claims submitted by persons, firms, subcontractors, and corporations furnishing materials for or performing labor in the performance of the Contract, including but not limited to claims for all amounts due for labor, materials, lubricants, oil, gasoline, repairs on machinery, equipment and tools, consumed or used by the Contractor or any subcontractor, wherein the same are not satisfied out of the portion of the contract price which the Jurisdiction is required to retain until completion of the improvement, but the Contractor and Surety shall not be liable unless the claims have been established as provided by law. The Contractor and Surety hereby bind themselves to the obligations and conditions set forth in Iowa Code Chapter 573.

3. MAINTENANCE: The Contractor and the Surety shall, at their own expense:
   A. Remedy any and all defects that may develop in or result from work to be performed under the Contract within the period of one (1) year(s) from the date of acceptance of the work under the Contract, by reason of defects in workmanship or materials used in construction of the work;
   B. Keep all work in continuous good repair; and
   C. Pay the Jurisdiction's reasonable costs of monitoring and inspecting to assure that any defects are remedied, and to repay the Jurisdiction all outlay and expense incurred as a result of Contractor's and Surety's failure to remedy any defect as required by this section.

Contractor's and Surety's obligation extends to defects in workmanship or materials not discovered or known to the Jurisdiction at the time the work was accepted.

4. GENERAL: Every Surety on this Bond shall be deemed and held bound, any contract to the contrary notwithstanding, to the following provisions:
   A. To consent without notice to any extension of time to the Contractor in which to perform the Contract;
   B. To consent without notice to any change in the Contract or Contract Documents, that increases the total contract price and the penal sum of this bond, provided that all such changes do not, in the aggregate, involve an increase of more than twenty percent of the total contract price, and that this Bond shall then be released as to such excess increase; and
   C. To consent without notice that this Bond shall remain in full force and effect until the contract is completed, whether completed within the specified contract period, within an extension thereof, or within a period of time after the contract period has elapsed and liquidated damages are being charged against the Contractor.

The Contractor and every Surety on this Bond shall be deemed and held bound, any contract to the contrary notwithstanding, to the following provisions:
   A. That no provision of this Bond or of any other contract shall be valid which limits to less than five years after the acceptance of the work under the Contract the right to sue on this Bond.
B. That as used herein, the phrase "all outlay and expense" is not to be limited in any way, but shall include the actual and reasonable costs and expenses incurred by the Jurisdiction including interest, benefits and overhead as applicable. Accordingly, "all outlay and expense" would include but not be limited to all contract or employee expense, all equipment usage or rental, materials, testing, outside experts, attorneys fees (including overhead expenses of the Jurisdiction's staff attorneys), and all costs and expenses of litigation as they are incurred by the Jurisdiction. It is intended the Contractor and Surety will defend and indemnify the Jurisdiction on all claims made against the Jurisdiction on account of Contractor's failure to perform as required in the Contract and Contract Documents, that all agreements and promises set forth in the Contract and Contract Documents, in approved change orders, and in this Bond will be fulfilled, and that the Jurisdiction will be fully indemnified so that it will be put into the position it would have been in had the Contract been performed in the first instance as required.

C. In the event the Jurisdiction incurs any "outlay and expense" in defending itself with respect to any claim as to which the Contractor or Surety should have provided the defense, or in the enforcement of the promises given by the Contractor in the Contract, Contract Documents, or approved change orders, or in the enforcement of the promises given by the Contractor and Surety in this Bond, the Contractor and Surety agree that they will make the Jurisdiction whole for all such outlay and expense, provided that the Surety's obligation under this Bond shall not exceed 125% of the penal sum of this Bond.

In the event that any actions or proceedings are initiated with respect to this Bond, the parties agree that the venue thereof shall be Polk County, State of Iowa. If legal action is required by the Jurisdiction to enforce the provisions of this Bond or to collect the monetary obligation accruing to the benefit of the Jurisdiction, the Contractor and Surety agree, jointly and severally, to pay the Jurisdiction all outlay and expense incurred by the Jurisdiction. All rights, powers, and remedies of the Jurisdiction hereunder shall be cumulative and not alternative and shall be in addition to all rights, powers and remedies given to the Jurisdiction, by law. The Jurisdiction may proceed against the Surety for any amount guaranteed hereunder whether action is brought against the Contractor or whether or not the Contractor is joined in the action.

NOW THEREFORE, the condition of this obligation is such that if the Principal shall faithfully perform all of the promises of the Principal, as set forth and provided in the Contract, in the Contract Documents, and in this Bond, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

When a word, term, or phrase is used in this Bond, it shall be interpreted or construed first as defined in this Bond, the Contract, or the Contract Documents; second, if not defined in the Bond, Contract, or Contract Documents, it shall be interpreted or construed as defined in applicable provisions of the Iowa Code; third, if not defined in the Iowa Code, it shall be interpreted or construed according to its generally accepted meaning in the construction industry; and fourth, if it has no generally accepted meaning in the construction industry, it shall be interpreted or construed according to its common or customary usage.
Failure to specify or particularize shall not exclude terms or provisions not mentioned and shall not limit liability hereunder. The Contract and Contract Documents are hereby made a part of this Bond.

Witness our hands, in triplicate, this __________ day of ______________________, 20 ______

<table>
<thead>
<tr>
<th>PRINCIPAL:</th>
<th>SURETY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor</td>
<td>Surety Company</td>
</tr>
<tr>
<td>By</td>
<td>By</td>
</tr>
<tr>
<td>Signature</td>
<td>Signature Attorney-in-Fact/Officer</td>
</tr>
<tr>
<td>Title</td>
<td>Name of Attorney-in-Fact/Officer</td>
</tr>
<tr>
<td>FORM APPROVED BY:</td>
<td>Company Name</td>
</tr>
<tr>
<td></td>
<td>Company Address</td>
</tr>
<tr>
<td>Kathleen Vanderpool</td>
<td>City, State Zip Code</td>
</tr>
<tr>
<td>Deputy City Attorney</td>
<td>Company Telephone Number</td>
</tr>
</tbody>
</table>

NOTE:

1. All signatures on this performance, payment & maintenance bond must be original signatures in ink; copies or facsimile of any signature will not be accepted.

2. This bond must be sealed with the Surety’s raised, embossed seal.

3. The Certificate or Power of Attorney accompanying this bond must be valid on its face and sealed with the Surety’s raised, embossing seal.

4. The name and signature of the Surety's Attorney-in-Fact/Officer entered on this bond must be exactly as listed on the Certificate or Power of Attorney accompanying this bond.

5. This bond form must be utilized as printed; no additions/deletions/alterations are permitted, other than providing the required information.
1) AWARD OF CONTRACT

The apparent low Bidder on this project will be required to furnish executed contract; Performance, Payment, and Maintenance Bond; Certificate of Insurance; and NPDES Certification Statements, if required, in substantial compliance with the contract documents to the Engineering Department before 12:00 noon on Friday, December 13, 2019. Completed documents in accordance with the contract documents and acceptable to the City of Des Moines Engineering and Legal Departments will be presented to the City Council for award of this contract on Monday, December 16, 2019. This would allow construction to begin upon issuance of the Notice to Proceed by the City Engineer.

By submission of a bid, the Bidder agrees that if the Bidder fails to furnish said executed contract; Performance, Payment, and Maintenance Bond; Certificate of Insurance; and NPDES Certification Statements, if required, in substantial compliance with the contract documents to the Engineering Department before 12:00 noon on Friday, December 13, 2019; the amount of the Bidder's bid security may become the property of the City and may be retained--not as a penalty but as liquidated damages. The award of the contract may then, at the discretion of the City, be made to the next-lowest responsible Bidder, or the work may be re-advertised or may be constructed by the City in any legal manner. Notice to Proceed will not be issued until the Contractor’s insurance is in compliance with the specifications.

The Bidder is reminded that all subcontractors must be approved by the City Council. The Council policy is that subcontractors be approved at the time the contract is awarded, if possible. The Bidder should submit a letter requesting approval of any subcontractors along with the subcontractor’s NPDES Certification Statement, if required, at the time its executed contracts are submitted for approval.

2) CONTRACT COMPLIANCE PROGRAM


a. EEO Program – Complaints of discrimination in violation of the Des Moines Human Rights Ordinance, or corresponding state or federal law, should still be filed with the appropriate city, state, or federal agency. If a Contractor is found by one of these agencies to be engaging in illegal discrimination, the Contractor will be in breach of its contract with the City of Des Moines and appropriate action will be taken.

b. DBE/TSB Program: Certification – The City of Des Moines’ program is a DBE/TSB Program whereby both certified DBEs and certified TSBs are equally eligible under the program. All DBEs shall be certified by the Iowa Department of Transportation (IDOT),
All TSBs shall be certified by the Iowa Department of Inspections and Appeals, and the Certified Directory of TSBs is available at the following website https://www.iowa.gov/tsb/index.php/search. The TSB website allows the user to search by name or other keyword. If the user enters the keyword "CONST" in the space next to Service Description and clicks SEARCH, the database will provide a listing of all TSBs that have identified various forms of construction as their type of work. The Directories will not be printed in the contract documents. Copies of the DBE and TSB Directories are available from the Engineering Department upon request.

c. DBE/TSB Program: Annual and Contract Goals – The City’s overall annual DBE/TSB goal will be based on the IDOT DBE overall annual goal established for the corresponding federal fiscal year as further adjusted and established by the Engineering Department to consider such factors as the current capacity of DBEs/TSBs to perform work, differences in the DBE versus TSB market, etc. By utilizing the IDOT overall annual DBE goal as the City’s overall annual DBE/TSB goal, the goal will be independently reviewed annually and updated regarding the availability of the DBEs that are ready, willing, and able to perform work. Many DBEs are also certified as TSBs and the availability is similar. The City’s overall annual DBE/TSB goal represents a target that the City would like to achieve by including DBE/TSB participation on City contracts; and is not a mandatory goal for this project. The Bidder is encouraged to use its best efforts to meet, and if possible exceed, the City’s overall annual DBE/TSB goal.

3) ALTERNATE SALES AND USE TAX

Section 1020, 1.08, B, of the General Supplemental Specifications shall apply to this contract. The Bidder should not include sales tax in the bid pursuant to Iowa Code. A sales tax exemption certificate will be available for all material purchased for incorporation in the project. Complete information on qualifying materials and supplies can be found at www.state.ia.us/tax, the Iowa Department of Revenue and Finance’s (IDRF) web site. Links are found in the Business Taxes and Local Government categories. Contact the IDRF at idrf@idrf.state.ia.us if you have questions on this requirement.
DEPARTMENT OF ENGINEERING
CITY OF DES MOINES, IOWA

SPECIAL PROVISION
CONTRACTUAL REQUIREMENTS

ON

DES MOINES FIRE STATION NO. 11

Activity ID 10-2019-001
SPECIAL PROVISION
CONTRACTUAL REQUIREMENTS
ON
DES MOINES FIRE STATION NO. 11
ACTIVITY ID 10-2019-001

GENERAL SUPPLEMENTAL SPECIFICATIONS TO SUDAS, 2019

AMENDMENT TO

SECTION 1030, 1.01, ACCEPTANCE OR REJECTION OF PROPOSALS: Add new paragraph H:

H. The bidder to whom the award of a Contract is under consideration shall submit the “CITY OF DES MOINES GENERAL CONTRACTOR QUALITY ASSURANCE QUESTIONNAIRE” form completed within 14 calendar days of notification by the City. Bidders who fail to submit the requested forms may be deemed to be non-responsive or non-responsible.

SECTION 1080, 1.10, SUBLETTING OR ASSIGNMENT OF CONTRACT: Add new paragraph 4:

4. General Contract bidders are required to manage, along with all other quality assurance requirements, provisions outlined within the “CITY OF DES MOINES SUBCONTRACTOR QUALITY ASSURANCE BID REQUIREMENTS” document included at the end of this Section.
CITY OF DES MOINES
POST-BID INFORMATION

GENERAL CONTRACTOR QUALITY
ASSURANCE QUESTIONNAIRE

DES MOINES FIRE STATION NO. 11
GENERAL CONTRACTOR QUALITY ASSURANCE QUESTIONNAIRE

Pursuant to Iowa Code §26.9 which requires that contracts for public improvements be awarded to the “lowest responsive, responsible bidder,” and also recognizes that a governmental entity may obtain information from the lowest responsive bidder to determine bidder’s responsibility relating to the bidder’s experience, number of employees, and ability to finance the cost of the public improvement, and in accordance with Iowa law allowing public entities to consider factors other than price in determining who is the lowest responsible bidder, the City of Des Moines does hereby provide the following Questionnaire to the bidder to whom award of a Contract is under consideration (“Contractor”) submitting bids for work on the Des Moines Fire Station No. 11 (“Project”). The fully completed Questionnaire, with attachments, shall be submitted to the City of Des Moines Engineering Department within 14 calendar days of notification to the apparent lowest bidder. Contractors who do not complete the following questionnaire may be deemed to be non-responsive or non-responsible.

1. Full name of Contractor:__________________________________________________________

   Address______________________________________________________________

   Telephone__________________________Fax__________________________

   Email______________________________________________________________

2. All other names under which Contractor has operated in the past five (5) years:

   ______________________________________________________________________

   ______________________________________________________________________

3. Provide Contractors’ Registration Number and full names of Registration Holders as per Iowa Construction Contractor Registration requirements:

   ______________________________________________________________________

   ______________________________________________________________________

   Contractor Registration Expiration Date____________________________________

4. Has Registration ever been suspended or revoked in any jurisdiction?
   ☐ Yes
   ☐ No

   If “yes”, provide information regarding suspension/revocation and attach all relevant documents.

5. Within the past five (5) years, has Contractor been debarred by any federal, state or local governmental entity from bidding on projects?
   ☐ Yes
   ☐ No
If "yes", provide information related to debarment.

6. On a separate sheet, list construction projects in value in excess of $5 million dollars that Contractor has in progress, giving the name of the project, owner, architect, contract amount, key Contractor personnel, percent complete and scheduled completion date.

7. On a separate sheet, list the major projects Contractor has completed in the past three (3) years, giving the name of the project, owner, architect, contract amount, Officer In Charge, Project Manager, Project Superintendent and any other key Contractor personnel, date of completion and percentage of the total project performed by your own employees.

8. On a separate sheet, identify the individuals Contractor intends to be the Officer in Charge, Project Manager, Project Superintendent and any other key personnel on this project. Include a resume and/or recent work history for each identified individual.

9. On a separate sheet, for work Contractor intends to self-perform on the project; specify the level of training and experience Contractors’ employees have had. Further indicate whether or not any such training has been in a United States Department of Labor (DOL) certified apprentice program. In the event Contractor intends to utilize apprentice workers on the Project, Contractor must be able to provide, upon Owners’ request, documentation that each apprentice worker utilized on the Project is properly registered as participating in a DOL certified apprentice program or substantially equivalent apprenticeship program.

10. On a separate sheet, list the Contractors last five (5) completed projects, and for each, the scheduled completion date and the final completion date, noting any owner approved extensions.

11. Within the past three (3) years, has Contractor defaulted on a contract, or been disqualified, removed or otherwise prevented from bidding on or completing any project
   □ Yes
   □ No
   If "yes", provide the year of the incident, name, address and telephone number of the owner of the project, project name and location.

12. Has Contractor ever been unable to obtain a bond or been denied a bond?
   □ Yes
   □ No
   If "yes", please provide all relevant details.
13. On a separate sheet, list all surety/bonding companies Contractor has utilized in the past five (5) years.

14. Has Contractor ever declared bankruptcy or been in receivership?
   □ Yes
   □ No
   If "yes" please provide all relevant details.

15. Is Contractor currently being investigated for or previously been found to have violated in the past five (5) years any of the following state or federal laws: Iowa Minimum Wage Act; Iowa Non-English Speaking Employees Act; Iowa Child Labor Act; Iowa Labor Commissioner's Right to Inspect Premises, Iowa Compensation Insurance Act; Employment Security Act; Iowa Competition Act; Iowa Income, Corporate and Sales Tax Code; a "willful" violation of the Iowa or Federal Occupational Safety and Health Act; Iowa Employee Registration Requirements; Iowa Hazardous Chemical Risks Act; Iowa Wage Payment Collection Act; Federal Income and Corporate Tax Code; The National Insurance Security Act; The Fair Labor Standards Act:
   □ Yes
   □ No
   If "yes" please explain:

16. Has Contractor ever failed to complete any work awarded to it?
    □ Yes
    □ No
    If "yes" provide all relevant details.

17. Are there any judgments, arbitration proceedings or suits pending or outstanding against Contractor or its officers that relate to, arise out of or are in the course of the Contractor's business?
    □ Yes
    □ No
    If "yes" provide all relevant details.

18. Has Contractor filed any lawsuit or demanded arbitration with regard to any construction contract within the past five (5) years?
    □ Yes
    □ No
    If "yes" provide all relevant details.
19. Has Contractor been found by a court or agency of competent jurisdiction to be delinquent in meeting its obligations under local, state or federal tax laws within the last five (5) years? ("delinquent" shall include, but is not limited to: failure to file, failure to pay or imposition of taxes)
   □ Yes
   □ No

20. Contractor affirms that it will retain only subcontracts who can fully comply with the bid specifications, including those that address requirements concerning labor.
   □ Yes
   □ No

21. Contractor affirms that it will be responsible for ensuring that each subcontractor meets quality assurance specifications.
   □ Yes
   □ No

22. Contractor agrees to submit to the City of Des Moines Engineering Department a list of all intended subcontractors within 14 calendar days of notification to the apparent lowest bidder. (In the event Contractor wishes to replace any originally-designated subcontractor, such may only occur with the approval of City of Des Moines. Such approval will not be unreasonably withheld)
   □ Yes
   □ No

23. Contractor attests that it will comply with each of the following:
   - Iowa’s Minimum Wage Law.
     □ Yes
     □ No
   - Maintain workers’ compensation insurance or be qualified as a self-insurer and provide proof of insurance or ability to self-insure upon request.
     □ Yes
     □ No
   - Properly license all Contractor employees with the appropriate licensing authority.
     □ Yes
     □ No

24. Contractor will make available to City or City’s representative, upon City’s request, documentation to satisfy the City, in City’s sole discretion, that the Contractors’ workers utilized on this project are actual employees, with unemployment and workers’ compensation coverage, not “leased employees” or independent contractors.
   □ Yes
   □ No
25. That Contractor will provide with this Questionnaire, the name, address, phone number and name of contact for three (3) entities which will provide references.
   ☐ Yes
   ☐ No

26. Contractor will only utilize on-site employees who have completed the Occupational Safety and Health Act (OSHA) 10-hour Construction Industry Training Program.
   ☐ Yes
   ☐ No

Provide Contractor's Federal ID Number __________________________________________

Provide Name and address of Contractor's Registered Agent __________________________

(Please continue to signature page)
I hereby certify, that (1) all of the information provide by me in this Questionnaire is true and correct to the best of my knowledge; (2) I am authorized to sign this Questionnaire on behalf of the Contractor whose name appears in Question #1; (3) if any of the information I have provided herein becomes inaccurate, prior to execution of any Project Contract. I will immediately provide City Engineering Department with updated accurate information in writing; and (4) I hereby authorize any person or entity named herein to provide City Engineering Department with whatever information might be required to verify this Questionnaire.

THIS STATEMENT MUST BE NOTORIZED

NAME OF CONTRACTOR

BY: ____________________________________________
    Signature                                  Title

_______________________________________________
Type/Print    Name                           Date

STATE OF IOWA, ___________________________ County, ss:

Subscribed and sworn to before me by the said ______________________ on this day of

_______________________________________________, 20________

_______________________________________________
Notary Public in and for the State of Iowa

_______________________________________________
Contractor Name
SPECIAL PROVISION
CONTRACTUAL REQUIREMENTS
ON
DES MOINES FIRE STATION NO. 11

SUBCONTRACTOR QUALITY ASSURANCE
BID REQUIREMENTS

The following requirements are intended to be included in the Quality Assurance Sections of the Bid Specifications which the Contractor will, along with all other quality assurance requirements, be required to manage:

FOR ALL SUBCONTRACTORS

Subcontractor must not be under current investigation for or previously have been found to have violated in the last five (5) years any of the following state or federal laws: Iowa Minimum Wage Act, Iowa Non-English Speaking Employees Act, Iowa Child Labor Act, Iowa Labor Commissioner’s Right to Inspect Premises, Iowa Compensation Insurance Act, Iowa Employment Security Act, Iowa Competition Act, Iowa Income, Corporate and Sales Tax Code, a “willful” violation of the Iowa or Federal Occupational Safety and Health Act, Iowa Employee Registration Requirements, Iowa Hazardous Chemical Risks Act, Iowa Wage Payment Collection Act, Federal Income and Corporate Tax Code, The National Insurance and Social Security Act, The Fair Labor Standards Act. Subcontractor must notify the Contractor of any current investigation of Subcontractor for violation of any of the above laws.

Subcontractor will only utilize Subcontractor on-site employees that have completed the Occupational Safety and Health Act (OSHA) 10 hour Construction Industry Training Program.

Subcontractor must properly license all employees with the appropriate licensing authority.
Subcontractor at all levels, that is even a subcontractor of a subcontractor, will only utilize workers on this Project that have unemployment and workers compensation coverage provided by the subcontractor by which the worker is employed. Subcontractor will make available to Contractor or City such documentation that is necessary to satisfy City, in City’s sole discretion, that subcontractor is in compliance with this provision.

**FOR SELECT SUBCONTRACTS**

These requirements shall apply to the following Subcontracts:

*List those subcontracts that will apply*

In the event Subcontractor intends to utilize apprentice workers, Subcontractor must participate in an apprentice or training program approved by the United States Department of Labor (DOL) or substantially equivalent apprenticeship or training program which has graduated at least one apprentice in the immediately preceding three-year period. Subcontractor must provide, upon City’s or Contractor’s request, documentation of such participation.

Subcontractor is not required to use apprentices on the Project. If subcontractor chooses to employ apprentices on this Project, subcontractor must provide upon request, evidence that each of the apprentices on the Project is participating in and registered with a DOL-approved apprentice or training program or substantially equivalent apprenticeship or training program.
Replace SECTION 1080, 1.01 SUBLET OR ASSIGNMENT OF CONTRACT with the following:

Delete all references in the section to “thirty percent” in reference to work to be performed by the contractor’s own organization and forces, and replace “thirty percent” with “ten percent” on all references.
SPECIAL PROVISION
CONTRACTUAL REQUIREMENTS
ON
DES MOINES FIRE STATION NO. 11
ACTIVITY ID 10-2019-001
PROPERTY INSURANCE – BUILDER’S RISK

The City of Des Moines will purchase and maintain Builder’s Risk Insurance on this project as referenced in the General Supplemental Specifications in Section 1070, 3.05A.2 (Builder’s Risk Insurance by the Jurisdiction). The Contractor need not purchase and maintain Builder’s Risk Insurance as referenced in Section 1070, 3.05A.1 (Builder’s Risk Insurance by Contractor) or an Installation Floater as referenced in Section 1070, 3.05A.3 (Installation Floater) in the General Supplemental Specifications.
SPECIAL PROVISION
CONTRACTUAL REQUIREMENTS
FOR NPDES PERMIT REQUIREMENTS ON

Des Moines Fire Station No. 11
Activity ID 10-2019-001

INDEX

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<td>9-11</td>
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1. GENERAL

A. This project is subject to Section 402(b) of the Clean Water Act and Iowa Code Section 455B.174 and Iowa Administrative Code 567-64.4 (projects disturbing one or more total acres) and requires inclusion in the National Pollution Discharge Elimination System (NPDES) General Permit No. 2, or an individual NPDES Permit for stormwater (also storm water) discharge associated with industrial activity for construction activities. All Work shall be in accordance with Section 9040 – Erosion and Sediment Control of the SUDAS Standard Specifications and the General Supplemental Specifications. Measurement for payment shall be in accordance with the General Supplemental Specifications.

B. The City of Des Moines has caused a general Storm Water Pollution Prevention Plan (SWPPP) to be prepared which is included in these contract documents. Said general SWPPP is based upon general construction methods and does not include any information regarding the Contractor’s scheduling or specific construction methods. The Contractor shall be responsible to review said general SWPPP, complete the SWPPP by providing data and/or information as necessary, and propose any revisions necessary for compliance with the General Permit No. 2 based on the Contractor’s proposed scheduling and construction methods. The Contractor will be responsible for the preparation of any modifications to said general SWPPP. If necessary, the Contractor shall be responsible to retain or engage persons knowledgeable in the preparation of a SWPPP. The SWPPP shall be prepared in a manner that complies with all applicable requirements.

C. The City of Des Moines will be responsible for publishing the Public Notice of Storm Water Discharge, as required for General Permit No. 2, and will provide the Contractor with the affidavits of publication for said notices.

D. Except as specifically otherwise stated herein, the Contractor shall be responsible for any and all compliance with erosion control, stormwater discharge, the SWPPP and/or permit requirements regarding same, including all fees. The Contractor shall be the “operator” of the project for all compliance purposes, notwithstanding the status of the City as a co-permittee. The Contractor shall indemnify the City and hold the City harmless from any and all claims, including without limitation penalties, fines, attorneys fees, consulting fees, and costs, arising out of the work at this project and/or the alleged violation of erosion control requirements, stormwater discharge and management, the SWPPP and/or permit requirements regarding same. The Contractor shall take prompt action to address and/or avoid any potential or real violation of same at their own cost.
E. The Contractor shall submit to the Engineer a copy of the Iowa Department of Natural Resources authorization prior to the City’s issuance of the Notice to Proceed for the work.

F. The Contractor shall incorporate all erosion control features into the project at the earliest practicable time, as outlined in the SWPPP or work schedule. Stormwater Pollution Prevention measures shall be constructed at locations shown in the contract documents and as determined by the Contractor, at locations where conditions develop during construction that were unforeseen during design, or where needed to control water pollution that develops during normal construction practices.

G. The Engineer may suspend operations, without cost to the City of Des Moines, if the Contractor fails to provide adequate erosion control measures in a timely manner.

2. GENERAL STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

A. Erosion and Sediment Controls

Erosion and Sediment Controls are measures to be used for controlling erosion and sediment throughout the construction project and include stabilization measures for controlling erosion from disturbed areas and structural controls to divert runoff and remove sediment. Contractor/subcontractor is responsible for the implementation and management of control measures specific to this site. As work progresses, field investigation may indicate additional erosion control measures may be required as determined by the contractor, owner, engineer, city or other governmentally regulated agencies.

1. Stabilization

   a. Preserve existing vegetation in areas not disturbed during construction.
   b. Area of disturbed soil at any one time by construction operations shall be held to a minimum.
   c. Temporary Stabilization - areas where construction activity is not planned to occur for at least 21 days will be stabilized by temporary erosion controls within 14 days of ceasing construction activities in that area.
      • Topsoil stockpiles and disturbed portions of the site will be stabilized with temporary mulch.
      • Frequent watering during construction in dry weather shall minimize wind erosion from exposed soil.
   d. Permanent Stabilization - areas where construction activity has permanently ended will be stabilized within 14 days of ceasing construction activities in that area.
      • Permanent seeding and mulch in all areas where final grading is complete.
      • Permanently seed drainage swales immediately upon reaching final grade to facilitate sediment deposition in surface runoff.
   e. Vegetative buffer strips
      • Where possible, existing vegetation strips should be left in place to increase infiltration and sediment deposition by reducing runoff velocity.
   f. Protection of Trees and Natural Vegetation
      • Undisturbed areas will utilize existing vegetation as a natural buffer zone to increase infiltration and sediment deposition by reducing runoff velocity.
   g. Dust Control
      • Utilize mulch or watering of surface to control wind erosion of susceptible soils during and/or immediately after mass site grading operations.
h. Stream Bank Stabilization
   • Stage the installation of any rip rap so that the time that the bank is disturbed is
     minimized.

2. Structural Controls
   a. At all areas where runoff can move offsite, silt fence or approved equal will be installed along
      the perimeter of the project downstream of disturbing activities. Also protect storm water
      discharge points prior to site clearing and grading operations as required and/or shown on the
      plans.
   b. Temporary sediment basins provided at the rate of 3,600 cubic feet of storage per acre for
      disturbed areas over 10 acres. If not attainable, a combination of silt fences, multiple
      sediment traps, or equivalent sediment controls are required for all side slopes and down
      slope boundaries of the disturbed area.
   c. Areas of 10 acres or less disturbed will require silt fence, sediment traps or equivalent
      measures for all side slopes and down slope boundaries of the disturbed area.
   d. Silt fences and ditch checks should be installed along concentrated drainage ways to control
      sediment deposition.
   e. Permanently seed all drainage swales immediately upon reaching final grade to facilitate
      sediment deposition in surface runoff. Use in conjunction with sediment traps, ditch checks,
      or other control measures to trap sediment.
   f. Additional silt fences or other measures may be required on all embankments, stockpiles and
      other areas to ensure runoff control.

B. Other Controls

Undertake measures for controlling other sources of potential pollution that may exist on the
construction site. During the course of construction, it is possible that situations may arise where
unknown materials will be encountered. When such situations occur, they will be handled according
to all applicable federal, state, and local regulations in effect at the time.

1. Waste materials
   a. Disposal of unused construction materials and construction material wastes shall comply with
      applicable state and local waste disposal, sanitary sewer, or septic system regulations. In the
      event of a conflict with other governmental laws, rules and regulations, the more restrictive
      laws, rules or regulations shall apply.

2. Hazardous waste
   a. Hazardous waste materials will be disposed of in accordance with applicable local, state,
      and/or federal regulations.
   b. Equipment refueling and maintenance operations will be carried out in such a manner so as to
      prevent any spills and contamination to the soil and groundwater.
   c. Potentially hazardous materials will be used with great care to prevent spillage in any
      volume.

3. Sanitary waste
   a. If a portable restroom facility is on the project site, wastes shall be collected and disposed of
      in complete compliance with local, state and federal regulations. This facility shall be located
      in an area where contact with the storm water discharge is minimal.

4. Vehicle tracking
   a. Stabilized construction entrances should be installed at all site access points to reduce vehicle
      tracking of sediment offsite.
b. Paved streets adjacent to the site shall be inspected daily and cleaned as necessary to remove any excess mud, dirt or rock tracked from the site.

c. Dump trucks hauling material shall be properly loaded or covered with a tarpaulin to prevent loss of material.

d. Dust control measures should be utilized as necessary.

5. Non-storm water discharges
   a. Expected sources of non-storm water discharges from the site during construction could include:
      • Potable water sources including water line flushings, irrigation drainage and fire fighting activities.
      • Uncontaminated groundwater from de-watering excavation.
      • Natural springs, wetland, water sources.
   b. Non-storm water discharges should be directed to non-erosive areas prior to discharge offsite.

C. Implementation: State and Local Requirements

1. The storm water pollution prevention plan reflects the State of Iowa requirements for storm water management and erosion and sediment control, as established in 161A.64 Code of Iowa, State of Iowa Statutory Requirements Pertaining to Erosion Control Plans.

2. Prior to initiating a land disturbing activity, a person engaged in land disturbing activity shall file a signed affidavit with the soil and water conservation district that the project will not exceed the soil loss limits.

3. All work shall be done in accordance with Division 9 of the SUDAS Standard Specifications as referenced in the contract.

4. Code Compliance: The Contractor shall comply with the soil erosion control requirements of the Iowa Code, the Iowa DNR NPDES permit and all local ordinances.

D. Implementation: Timing of Controls/Measures

1. Install down-slope and side-slope perimeter silt fence prior to commencing land-disturbing activity.

2. Install construction entrance and vehicle tracking controls.

3. Construct sediment basins, ditch checks, or other erosion control measures at storm water discharge points.

4. Do not disturb an area until necessary for construction to proceed.

5. Install interior silt fences, sediment traps, etc. as grading progresses.

6. Cover or stabilize disturbed areas as soon as possible and no later than 14 days after ceasing construction for more than 21 days or permanently.

7. Construct riprap aprons at storm outlets and creek crossings that are disturbed by the construction.

8. Place swale control measures (erosion control mats, silt traps, ditch checks, seed & mulch) in drainage ways as soon as final grades are achieved.

9. As areas reach their final grade, provide additional silt fence, sediment traps, earthen dikes, and ditch checks as necessary.

10. Complete permanent stabilization seeding as soon as possible after work is complete.

11. Remove temporary sediment controls and accumulated sediment once entire site is stabilized. Re-seed any areas disturbed during removal.
E. Hazardous substance spill prevention and response

1. The Contractor is responsible for training all personnel in the proper handling and cleanup of spilled materials. No spilled hazardous materials or wastes will be allowed to come into contact with storm water discharges. If contact does occur, the storm water discharge will be contained onsite until appropriate measures in compliance with all federal, state, and local regulations are followed to dispose of the hazardous substance.

2. In addition to good housekeeping and material management practices, the following practices shall be done by the Contractor to minimize the potential for hazardous material spills and to reduce the risk of the spill coming in contact with storm water.
   - Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.
   - Materials and equipment necessary for spill control, containment and cleanup will be provided onsite in a material storage area.

3. In the event of a spill, the following procedures will be followed by the Contractor:
   - All spills will be cleaned up immediately following discovery.
   - The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with the hazardous substance.
   - Spill of toxic or hazardous material will be reported to the appropriate state or local governmental agency and to the project manager and engineer, regardless of the size of the spill.

4. In the event the construction site has a release of a hazardous substance or oil in an amount which exceeds a reportable quantity (RQ) as defined at 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302 then the Contractor shall:
   - Have its person in charge of the site at the time of the spill immediately call the EPA National Response Center to report the spill (800-424-8802, or 202-426-2675).
   - Modify the Pollution Prevention Plan accordingly within 14 days of the spill including the items mentioned below.
   - Within 14 days of the release, submit a written description of the release including: a description of the release, type of material, estimated amount of spill, date of release, explanation of why the spill happened, and a description of the steps taken to prevent and control future releases.

F. Materials Management

Site sources of pollution generated as a result of this work related to silts and sediment which may be transported as a result of a storm event. However, this SWPPP provides conveyance for other (non-project related) operations. These other operations have storm water runoff, the regulation of which is beyond the control of this SWPPP.

1. Materials or substances expected to be present onsite during construction:
   a. Concrete
   b. Detergents
   c. Glue
   d. Tar
   e. Fertilizers
   f. Petroleum based additives
   g. Wood
   h. Solids and construction wastes
2. Material Management Practices – the following is a list of practices that will be used by the Contractor on site to minimize the risk of spills or other accidental exposure of materials and substances to storm water runoff.
   a. Good housekeeping
      • An effort will be made to store onsite only enough products required to complete the job.
      • All materials stored onsite will be kept in a neat, orderly manner and in their appropriate containers. If possible, products shall be kept under a roof or other enclosure.
      • Materials will be kept in their original containers with the original manufacturer’s label.
      • Substances will not be mixed with one another unless recommended by the manufacturer.
      • Whenever possible, all of a product will be used up before disposing of the container.
      • Manufacturer’s recommendations for proper use and disposal will be followed.
      • The job site superintendent will be responsible for daily inspections to ensure proper use and disposal of materials.
   b. Hazardous products
      • Products will be kept in their original containers with the original manufacturer’s label.
      • The original labels and material safety data sheets will be kept for each of the materials as they contain important product information.
      • Disposal of any excess product will be done in a manner that follows all manufacturers’, federal, local and state recommended methods for proper disposal.

3. Product Specific Practices – the following is a list of potential sources of pollution and specific practices to be used by the Contractor to reduce pollutant discharges from materials or sources expected to be present during construction.
   a. Petroleum Storage Tanks
      • All onsite vehicles shall be inspected and monitored for leaks and receive preventative maintenance to reduce the chance of leakage.
      • Steps will be taken by the Contractor to eliminate contaminants from storage tanks from entering ground soil. Any petroleum storage tanks kept onsite will be located with an impervious surface between the tank and the ground.
   b. Fertilizers – shall be applied in the amounts specified. It shall be worked into the soil as to minimize the contact with storm water discharge.
   c. Concrete wastes
      • Concrete trucks will be allowed to washout or discharge excess concrete only in specifically designated areas which have been prepared to minimizes contact between the concrete and storm water discharge from the site.
      • The hardened product from the concrete washout areas will be disposed of by the Contractor as other non-hazardous waste materials or may be broken up and used on the site for other appropriate uses.
   d. Solid and construction wastes – All trash and construction debris shall be collected and disposed of offsite by the Contractor. No construction waste materials will be buried onsite.
# 3. SITE INFORMATION

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Des Moines Fire Station No: 11, Activity ID 10-2019-001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Location</td>
<td>City of Des Moines, Polk County, Iowa</td>
</tr>
<tr>
<td>(address, lat./long.</td>
<td>Section 21, Township 79N, Range 23W</td>
</tr>
<tr>
<td>or Section-T-R)</td>
<td></td>
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<tr>
<td>Owner Name</td>
<td>City of Des Moines</td>
</tr>
<tr>
<td>Representative</td>
<td>Tim Brady</td>
</tr>
<tr>
<td>Owner Address/Phone</td>
<td>Engineering Department</td>
</tr>
<tr>
<td></td>
<td>City Hall - 400 Robert D. Ray Drive</td>
</tr>
<tr>
<td></td>
<td>Des Moines, Iowa</td>
</tr>
<tr>
<td></td>
<td>Office Phone: 515-283-4025</td>
</tr>
<tr>
<td></td>
<td>Cell Phone: 515-208-4025</td>
</tr>
<tr>
<td>Contractor Name</td>
<td></td>
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<tr>
<td>Representative</td>
<td></td>
</tr>
<tr>
<td>Contractor Address/Phone</td>
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<tr>
<td>Site Area</td>
<td>Approximately 3 Acres</td>
</tr>
<tr>
<td>Disturbed Area</td>
<td>Approximately 3 Acres</td>
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<tr>
<td>Final Runoff Coefficient</td>
<td>0.50</td>
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<tr>
<td>Soil type / characteristics</td>
<td>Sandy Loam</td>
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<tr>
<td>Receiving Waters</td>
<td>Four Mile Creek/Des Moines River</td>
</tr>
<tr>
<td>Description (purpose</td>
<td>This project or work involves following described</td>
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<tr>
<td>and types of soil</td>
<td>improvement: The improvement includes construction of</td>
</tr>
<tr>
<td>disturbing activities</td>
<td>an approximately 14,600 SF new fire station which</td>
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<td>includes a two-story mechanical area, living quarters,</td>
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<td></td>
<td>and a three bay apparatus area; design consists of</td>
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<td>cast stone, brick masonry, glazed aluminum curtainwall</td>
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<td></td>
<td>and architectural aluminum metal panels; wall structure</td>
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<td>consists of perimeter bearing walls and internal</td>
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<td></td>
<td>bearing and non-bearing concrete masonry units; floor</td>
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<td></td>
<td>structure is steel beam framing and concrete/metal floor</td>
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<tr>
<td></td>
<td>decking; roof structure is metal roof joists and</td>
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<tr>
<td></td>
<td>decking; roofing system is a single-ply, fully adhered</td>
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<td></td>
<td>membrane on low slope roof areas and metal roof for the</td>
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<tr>
<td></td>
<td>apparatus bay; reconstruction of East 42nd Street; all</td>
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<tr>
<td></td>
<td>work in accordance with the contract documents,</td>
</tr>
<tr>
<td></td>
<td>including Plan File Nos. 601-070/251, located at 4150</td>
</tr>
<tr>
<td></td>
<td>East 42nd Street, Des Moines, Iowa</td>
</tr>
<tr>
<td>Expected Sequence of</td>
<td>Soil disturbing activities necessary to complete the work</td>
</tr>
<tr>
<td>Major Construction</td>
<td>are, rough grading, final grading, and surface</td>
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<tr>
<td>Activities to be</td>
<td>restoration. Site sources of pollution generated as a</td>
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<tr>
<td>Completed by</td>
<td>result of this project relate to silts and sediments</td>
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<td>Contractor (subject</td>
<td>that may be transported as a result of a stormwater event</td>
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<td>to change; any</td>
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<tr>
<td>deviations shall be</td>
<td></td>
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<td>noted on this plan)</td>
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</table>
4. PUBLIC NOTICE OF STORM WATER DISCHARGE

The City of Des Moines, or its Contractor for the following work, plans to submit a Notice of Intent to the Iowa Department of Natural Resources to be covered under NPDES General Permit No. 2 “Storm Water Discharge Associated with Industrial Activity for Construction Activities.” The storm water discharge will be from the construction of the Des Moines Fire Station No. 11 Activity ID 10-2019-001.

located in Sec. 21, T79N, R23W, Polk County

Storm water will be discharged from ______ point source and will be discharged to the following stream: ______ Four Mile Creek/Des Moines River_____.

Comments may be submitted to the Storm Water Discharge Coordinator, IOWA DEPARTMENT OF NATURAL RESOURCES, Environmental Protection Division, 502 E. 9th Street, Des Moines, IA, 50319-0034. The public may review the Notice of Intent from 8:00 a.m. to 4:30 p.m., Monday through Friday, at the above address after it has been received by the department.

Published in the Des Moines Register
November 6, 2019
5. NPDES CERTIFICATION STATEMENT

A. This project is subject to Section 402(b) of the Clean Water Act and Iowa Code Section 455B.174 and Iowa Administrative Code 567-64.4 (projects disturbing one or more total acres) and requires inclusion in the National Pollution Discharge Elimination System (NPDES) General Permit No. 2, or an individual NPDES Permit for stormwater (also storm water) discharge associated with industrial activity for construction activities. A general stormwater pollution prevention plan for this project is included in the contract documents. A copy of the stormwater pollution prevention plan must be kept at the construction site from the time construction begins until the site has reached final stabilization. The Contractor must sign the NPDES Certification Statement and submit it with the contract documents. By doing so the Contractor becomes a co-permittee with the City of Des Moines and other co-permittee contractors. The Contractor is solely responsible for the development and implementation of a specific stormwater pollution prevention plan for this project, as necessary and appropriate to comply with the law, and must identify any contracting entity charged with the development and/or implementation of any portion of the stormwater pollution prevention plan. The Contractor is the party responsible for maintaining compliance with the stormwater pollution prevention plan and NPDES Permit for the project.

B. All subcontractors, including short-term contractors and subcontractors, prior to approval, must sign the NPDES Certification Statement before conducting any work at the site. The certification must be signed in accordance with the signatory requirements found in the general permit; i.e., principal executive officer, vice president, general partner, proprietor, elector official, and will be incorporated into the Stormwater Pollution Prevention Plan (SWPPP).

C. Upon signing the certification and to the extent allowed by law, other contractors and sub-contractors become co-permittees with the City of Des Moines, the Contractor, and other co-permittees. In signing the plan, the authorized representative certifies that the information is true and assumes liability for the plan. Note that Section 309 of the Clean Water Act provides for significant penalties where information is false or the permittee violates, either knowingly or negligently, permit requirements.

D. All contractors/subcontractors shall conduct their operations in a manner that minimizes erosion and prevents erosion of sediment from the project site. The Contractor shall be responsible for compliance and implementation of the SWPPP for their entire contract. The Contractor is responsible for the identification, coordination and cooperation of all other contractors and subcontractors whose work is a likely source of potential pollution under the law, the NPDES permit and the SWPPP, and to develop and implement the SWPPP.

E. A copy of the NPDES Certification Statement of the Contractor and all subcontractors shall be filed with the City of Des Moines and shall also become a part of the project SWPPP.
NPDES CERTIFICATION STATEMENT
of Contractor or Subcontractor

"I certify under penalty of law that I understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site as part of this certification. Further, by my signature, I understand that I am becoming a co-permittee, along with the owner(s) and other contractors and subcontractors signing such certifications, to the Iowa Department of Natural Resources NPDES General Permit No. 2 for 'Storm Water Discharge Associated with Industrial Activity for Construction Activities' at the identified site. As a co-permittee, I understand that I, and my company, are legally required under the Clean Water Act and the Code of Iowa, to ensure compliance with the terms and conditions of the storm water pollution prevention plan developed under this NPDES permit and the terms of this NPDES permit.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

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NOTE:
1) The signature on this certification must be an original signature in ink; copies or facsimile of any signature will not be accepted.
2) The Contractor and all subcontractors must sign the NPDES certification statement and return it to the City Engineer before conducting any work at the site. The certification must be incorporated in the SWPPP.
3) The person who signs this certification for the Contractor or subcontractor shall be:
   a. Corporations. In the case of a corporation, a principal executive officer of at least the level of vice president.
   b. Partnerships. In the case of a partnership, a general partner.
   c. Sole proprietorships. In the case of a sole proprietorship, the proprietor.
CORPORATE ACKNOWLEDGMENT

STATE OF __________) ) SS
__________ COUNTY)

On this _____ day of ____________, 20___, before me, the undersigned, a Notary Public in and for the State of ____________, personally appeared ____________________________ and ____________________________, to me known, who, being by me duly sworn, did say that they are the ____________________________, and ____________________________, respectively, of the corporation executing the foregoing instrument; that (no seal has been procured by) (the seal affixed thereto is the seal of) the corporation; that said instrument was signed (and sealed) on behalf of the corporation by authority of this Board of Directors; that ____________________________, and ____________________________ acknowledged the execution of the instrument to be the voluntary act and deed of the corporation, by it and by them voluntarily executed.

Notary Public in and for the State of
My Commission expires ____________, 20___

PARTNERSHIP ACKNOWLEDGMENT

STATE OF __________) ) SS
__________ COUNTY)

On this _____ day of ____________, 20___, before me, the undersigned, a Notary Public in and for the State of ____________, personally appeared ____________________________, to me personally known, who being by me duly sworn, did say that the person is one of the partners of ____________________________, a partnership, and that the instrument was signed on behalf of the partnership by authority of the partners and the partner acknowledged the execution of the instrument to be the voluntary act and deed of the partnership by it and by the partner voluntarily executed.

Notary Public in and for the State of
My commission expires ____________, 20___

LIMITED LIABILITY COMPANY ACKNOWLEDGEMENT

STATE OF __________) ) SS
__________ COUNTY)

On this _____ day of ____________, 20___, before me the undersigned, a Notary Public in and for the State of ____________, personally appeared ____________________________, to me personally known, who being by me duly sworn did say that person is ____________________________, of said ________________, that (the seal affixed to said instrument is the seal of said OR no seal has been procured by the said) ____________________________, and that said instrument was signed and sealed on behalf of the said ____________________________, by authority of its managers and the said ____________________________ acknowledged the execution of said instrument to be the voluntary act and deed of said ____________________________, by its voluntarily executed.

Notary Public in and for the State of
My commission expires ____________, 20___
ENGINEERING DEPARTMENT
CITY OF DES MOINES, IOWA

TECHNICAL SPECIFICATIONS
FOR

DES MOINES FIRE STATION NO. 11
Activity ID No. 10-2019-001
DES MOINES FIRE STATION NO. 11
ACTIVITY ID 10-2019-001
DES MOINES, IA

PROJECT MANUAL
October 15, 2019

ARCHITECT AND INTERIOR DESIGNER:
SVPA ARCHITECTS INC.
1466 28th Street, Suite 200
West Des Moines, IA  50266
515.280.2419 FAX 515.327.5991
Contact: Josh Ridgely, AIA, CDT, LEED AP BD+C
j-ridgely@svpa-architects.com

OWNER:
CITY OF DES MOINES/FIRE DEPARTMENT
400 Robert D. Ray Drive
Des Moines, IA 50309

CIVIL ENGINEER:
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3501 104th Street
Urbandale, IA 50322
515.276.0467
Contact: Chuck Bishop, PE
cbishop@bishopengr.com

STRUCTURAL ENGINEER:
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2882 106th Street
Urbandale, IA 50322
515.334.7936
Contact: Alex Carnahan, PE
alex.d.carnahan@imegcorp.com

MEP ENGINEER:
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2882 106th Street
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Mechanical Contact: Dave Inghram, PE
515.334.4325, david.c.inghram@imegcorp.com
Electrical Contact: Isaac Stoll, PE
515.334.4321, isaac.p.stoll@imegcorp.com

ACTIVITY ID 10-2019-001
Des Moines Fire Station No. 11
Activity ID 10-2019-001

City of Des Moines/Fire Department
400 Robert D. Ray Drive
Des Moines, IA 50309

18079

ARCHITECT:
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I hereby certify that the portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed architect/licensed engineer under the laws of the State of Iowa.

**DESIGN PROFESSIONALS OF RECORD**

**ARCHITECT**
Robert T. Ormsby, AIA  
License No. 5591  
License Renewal Date: 6/30/21

Divisions 1 - 33 Sections covered by this seal, except where indicated as prepared by other design professionals of record

**CIVIL ENGINEER**
Charles Bishop, PE  
License No. 5141  
License Renewal Date: 12/31/20

Sections covered by this seal:  
Divisions 31-33

**STRUCTURAL ENGINEER**
Alexander D. Carnahan, PE  
License No. 21414  
License Renewal Date: 12/31/20

Sections covered by this seal:  
031000, 032000, 033000, 034100, 042200, 051223, 052100, 053100

**MECHANICAL ENGINEER**
David C. Inghram, PE  
License No. 12567  
License Renewal Date: 12/31/20

Sections covered by this seal:  
Divisions 21 - 23
October 15, 2019

ELECTRICAL ENGINEER
Andrew D. Thielen, PE
License No. 15842
License Renewal Date: 12/31/20

Sections Covered by this seal:
Divisions 26-28

END OF DOCUMENT 000005
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W.2 E. 42ND STREET CROSS SECTIONS
1.1 DEFINITIONS

A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.

B. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award.

1.2 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.

1.3 PROCUREMENT SUBSTITUTIONS

A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:
1. Extensive revisions to the Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
3. The request is fully documented and properly submitted.

1.4 SUBMITTALS

A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing in compliance with the following requirements:
1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
2. Submittal Format: Submit one copy of each written Procurement Substitution Request, using form bound in Project Manual, CSI Substitution Request Form 1.5C. Email Requests are preferred. Refer to the Project Manual Title Page for Architect email address.
   a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
   b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:
      1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
      2) Copies of current, independent third-party test data of salient product or system characteristics.
      3) Samples where applicable or when requested by Architect.
4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

6) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES.

7) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.

c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.

d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

e. Provide LEED information as applicable. See Section 01 81 13.14.

B. Architect's Action:
   1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Owner will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

C. Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT 00 26 00
SUBSTITUTION REQUEST
(During the Bid Period)

Project: ___________________________ Substitution Request Number: __________________

From: _____________________________ Date: _____________________________

To: _____________________________ A/E Project Number: __________________

Re: _____________________________ Contract For: __________________

Specification Title: ___________________________ Description: __________________

Section: _______________ Page: _______________ Article/Paragraph: ____________

Proposed Substitution: ___________________________ Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Manufacturer: ___________________________ Address: _____________________________ Phone: _____________________________

Trade Name: ___________________________ Model No.: _____________________________

The Undersigned certifies:
• Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.  
• Same warranty will be furnished for proposed substitution as for specified product.  
• Same maintenance service and source of replacement parts, as applicable, is available.  
• Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.  
• Proposed substitution does not affect dimensions and functional clearances.  
• Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____________________________
Signed by: _____________________________
Firm: _____________________________
Address: _____________________________ Telephone: _____________________________

A/E’s REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.  
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.  
☐ Substitution rejected - Use specified materials.  
☐ Substitution Request received too late - Use specified materials.

Signed by: _____________________________ Date: _____________________________

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

© Copyright 2007, Construction Specifications Institute, 110 South Union Street, Suite 100, Alexandria, VA 22314 Page 1 Form Version: June 2004 CSI Form 1.5C

This is not an official CSI Construction Contract Administration (CCA) Form. Please use CSI’s official CCA Forms if required by your project needs.
GEOTECHNICAL DATA

A Geotechnical report has been prepared as a service to the Owner for the project involving Des Moines Fire Station No. 11. A copy of the complete report is attached at the end of this Section. This report identifies properties of below grade conditions primarily for the use of the Architect/Engineer. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in the Contract Documents.

This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Sum accruing to the Owner.

SITE SURVEY

A site survey has been prepared as a service to the Owner for the site referenced above. The survey and site demolition information are included in the Project Drawings.

This survey identifies existing utilities and grade elevations and was prepared primarily for the use of the Architect/Engineer in establishing new grades, identifying natural water shed, and utility connections and modifications.

INTERPRETATION

No representation or warranty is made by SVPA Architects Inc. or the Owner of the adequacy or contents of this Information Available to Bidders.

Information Available to Bidders is not a part of the Contract Documents.

END OF DOCUMENT 00 30 00
April 30, 2019

GEOTECHNICAL EXPLORATION

DES MOINES FIRE STATION NO. 11
4144 HUBBEL AVENUE
DES MOINES, IA

ACTIVITY ID NO. 21-2019-032

PERFORMED FOR

CITY OF DES MOINES
400 ROBERT D. RAY DRIVE
DES MOINES, IOWA 50309
April 30, 2019

City of Des Moines
400 Robert D. Ray Drive
Des Moines, Iowa 50309
Attn: Mr. Tim Brady, Project Engineer

RE: Geotechnical Exploration
Des Moines Fire Station No. 11
4144 Hubbell Avenue
Des Moines, IA
PN 191104
Activity ID No. 21-2019-032

Dear Mr. Brady:

As authorized by Steven L. Naber, P.E. City Engineer, on March 14, 2019, Allender Butzke Engineers Inc. (ABE) has completed the geotechnical exploration for the above referenced project. The geotechnical exploration was conducted to evaluate physical characteristics of subsurface conditions with respect to design and construction of this project. The enclosed report summarizes the project characteristics as we understand them, presents the findings of the borings and laboratory tests, discusses the observed subsurface conditions, and provides geotechnical engineering recommendations for this project.

We appreciate the opportunity to provide our geotechnical engineering services for this project. If you have any questions or need further assistance, please contact us at your convenience. We are also staffed and equipped to provide construction testing and inspection services on this project as well as environmental site assessments.

Respectfully submitted,
ALLENDER BUTZKE ENGINEERS INC.

Seth Hansen, E.I.
Staff Engineer

Milton R. Butzke, P.E.
Senior Principal Engineer

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Milton R. Butzke, P.E. License Number 8520 Date
My license renewal date is December 31, 2020.
Pages covered by this seal: ___ All Pages ___

1 PC and 1 Email Above
1 PC and 1 Email SVPA; Attn: Robert Ormsby, AIA, LEED AP
1 Email IMEG Corporation; Attn: Alex Carnahan, SE, PE
1 Email Bishop Engineering Company; Attn: Eric Miller, P.E.
GEOTECHNICAL EXPLORATION

DES MOINES FIRE STATION NO. 11
4144 HUBBELL AVENUE
DES MOINES, IA

PN 191104

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  Site Plan
PROJECT INFORMATION

The City of des Moines with design assistance from SVPA Architects (SVPA), Bishop Engineering Company (Bishop), and IMEG Corporation is planning the construction of the Des Moines Fire Station No. 11 to be located at 4144 Hubbell Avenue. Project information was provided by SVPA and Bishop. The following Figure No. 1 shows the proposed site layout and approximate boring locations.

The new 16,000 square feet slab-on-grade structure has a preliminary finish floor elevation (FFE) of 153.0 feet. Based on projects of similar size, we assume the new structure will generate light to moderate structural loads i.e. continuous wall loads of 5 kips per lineal foot or less and
isolated column loads of 100 kips or less. The heavily loaded floors in the apparatus bays, possibly being up to 8 inches thick, may have trench drains to collect truck runoff.

The existing Relax Inn motel with an attached residence and several other structures are currently located on the site and will be demolished for site development. Existing paved drives and parking areas traverse the site and are surrounded by grass covered areas. Much of the project area is relatively level between the motel and the streets. The preliminary Grading Plan provided by Bishop indicated the existing ground elevations range from about 155 feet in front of the motel sloping up to about 159 feet near the street intersection. The ground surface slopes down to the east to the adjacent apartment complex parking lot to near elevation 154 feet. The ground continues slope down to a wooded area north of the motel to elevation 137 feet in northeast corner of the property.

Based on a finish floor elevation (FFE) of 153.0 feet, we estimate cut depths of 2 feet or less and new fill thicknesses of up to 6 feet will be required to achieve desired grades below the building. A retaining wall between 2 and 3.5 feet tall is planned on the north side of the building to accommodate the raised grades. Deeper cuts of up to 8 feet will be required for the dry detention basin south of the proposed fire station. Shallower detention basins on the order of 3 feet deep are planned on the east and northwest corners of the property.

FIELD EXPLORATION

Five borings were conducted at this site to depths between 15 and 60 feet below existing grades on April 5 and 8, 2019. Approximate locations of the borings are shown on the enclosed Site Plan. Boring locations and ground surface elevations were determined using GPS survey equipment. The boring surface elevations, indicated on the enclosed Boring Logs, were Iowa Real-Time Network (RTN) derived. Methods of drilling, sampling, standard laboratory testing, and classifying of subsurface materials are discussed in the Boring Log Description/Legend pages of the Appendix.

SUBSURFACE CONDITIONS

Site Geology

This project site is located within a geomorphic region known as the "Des Moines Glacial Lobe". The Wisconsinan glacier was the last glacier to advance into north central Iowa. The Wisconsinan glacial till present near the surface typically consists of sandy lean clay with random zones of high sand and silt content. Loess is typically encountered underlying the Wisconsinan glacial till. The loess is an eolian "wind-blown" deposit derived from flood plain sediments
associated with major glacial meltwater streams and tends to have relatively uniform silt and clay particle sizes.

Pre-Illinoian glacial till was the former near surface soil before loess deposition and is typically a high clay content soil. The less weathered portions of the deeper Pre-Illinoian glacial till consist of a more homogeneous mixture of sand, silt and clay.

Pennsylvanian bedrock composed of alternating layers of shale, sandstone, and limestone with lesser extensive layers of coal and other sedimentary bedrock units underlie the glacial and eolian overburden deposits at depths of about 50 feet or deeper below ground surface.

The near surface natural soil profile has been altered by past grading including cutting surficial soils and filling over natural soils.

**Soil Profile**

Detailed descriptions of soils encountered by this exploration are provided on the Boring Logs enclosed in the Appendix. The Profile of Borings (Plate A-1) presented in the Appendix depicts the relative deposit elevations in the borings. Unless otherwise indicated, the depths of soil stratum and groundwater levels are referenced from below the top of existing ground at the individual boring locations at the time of drilling.

Four inches of hot mix asphalt (HMA) overlaid 6 inches of Portland cement concrete (PCC) at the ground surface in Boring No. 3. Existing fill consisting of very dark brown, dark brown, and brown sandy lean clay (CL) and sandy lean to fat clay (CL-CH) was present at the ground surface in Boring Nos. 1, 2, 4, and 5 and underlying the pavement in Boring No. 3. The existing fill was soft to medium stiff and extended to depths between 1.5 and 4.5 feet. An Atterberg Limits test conducted on a sample of existing fill collected from Boring No. 5 resulted in a Liquid Limit (LL) of 42 and Plasticity Index (PI) of 26 and is considered moderately expansive.

Wisconsinan glacial till consisting primarily of brown-gray sandy lean clay (CL) with trace amounts of gravel underlaid the existing fill in all borings. The upper 2 to 3 feet of the Wisconsinan glacial till in Boring Nos. 2 and 4 was moderately plastic (LL of 44, PI of 26) and is considered moderately expansive. As is common in glacial till deposits a clayey medium to coarse sand (SC) layer was encountered in Boring No. 5 between depths of 12 and 14 feet. Boring Nos. 1, 2, 4, and 5 terminated in Wisconsinan glacial till near depths of 15 and 20 feet.

Dark gray lean clay (CL) loess underlaid the Wisconsinan glacial till in Boring No. 3. The loess was stiff and moist to very moist. Earlier glacial deposits, termed Pre-Illinoian glacial till, underlaid the loess below a depth of 38 feet in Boring No. 3. This deeper glacial deposit was very stiff and consisted of sandy lean to fat clay (CL-CH) with trace amounts of gravel.
Pennsylvanian bedrock composed of shale underlaid the overburden deposits of glacial till, loess, and Pre-Illinoian glacial till below a depth of 50 feet. The upper portion of the shale bedrock was weathered, moist, very stiff, and generally became less weathered and harder with increasing depth. Boring No. 3 terminated in very hard gray limestone near a depth of 59 feet.

Hydrocarbon odor was present in Boring No. 4 below a depth of 13 feet. The scope of our service was not intended to include any environmental assessment or exploration for the presence of hazardous or toxic materials in the soil, surface water, groundwater or air on, below or adjacent to this site. Please contact us if additional environmental services and consultation are requested.

**Groundwater Level Observations**

The borings were monitored during and shortly after drilling operations to detect moisture seepage and groundwater accumulation. The results of our water level observations are noted on the Boring Logs enclosed in the Appendix.

During drilling operations, moisture seepage was noted near respective depths of 7 and 9 feet below existing grades in Boring Nos. 1 and 4. Groundwater accumulation was observed near depths of 12 and 20 feet in Boring Nos. 1 and 3 shortly after the completion of drilling operations. Boring No. 2 was caved-in and wet near a depth of 19 feet while no groundwater accumulation was observed in the remaining borings. These short-term water levels are not necessarily a true indication of the groundwater table. Long-term observations would be necessary to accurately define the groundwater variations at this site.

Brown-gray coloring of the Wisconsinan glacial till is an indication of past fluctuations of the groundwater in this zone. Therefore, we interpret that past seasonal high water tables have been near depths of 4 to 6 feet or deeper below existing grades. Fluctuation of groundwater levels can occur due to seasonal variations in the amount of rainfall, surface drainage, subsurface drainage, site topography, irrigation practices, and ground cover (pavement or vegetation).

**ANALYSES AND RECOMMENDATIONS**

**Site Preparation**

Site preparation will include demolition of the existing structures and abandonment or relocation of utilities. We recommend that all foundations, floor slabs, below grade walls, and pavement sections be completely removed and be replaced with engineered compacted fill which meets or exceeds the *Class I Construction Application* requirement in Table A in the following *Site Grading* section. Any abandoned utility lines should be completely removed or capped and
grouted full. Construction debris removed from this site should be properly disposed in a construction/demolition landfill or recycling facility.

**Existing Fill**

In our opinion, the existing fill encountered at this site would not provide reliable support for the proposed building foundations and floor slabs due to the fill’s variable material content, consistency, and the associated structural support uncertainties. Therefore, we recommend all the existing fill be completely over-excavated beneath the building during site preparation and be replaced with engineered compacted fill. Boring information suggests over-excavation depths between 1.5 and 4.5 feet will be required to remove the existing fill although deeper fill sections may be encountered in other unexplored areas of the site. We recommend that extensive geotechnical probing, testing, and observations be conducted by an ABE geotechnical engineer during over-excavation/construction to further note suitability and support capability of the existing soils beneath the proposed building. Portions of the existing fill that are free of rubble and organics would be suitable for re-use as engineered compacted fill with consideration given to its moderately expansive nature as described in the following *Site Grading* section of this report.

**Moderately Expansive Soil**

The lean to fat clay portions of the (CL-CH) Wisconsinan glacial till and lean to fat clay (CL-CH) existing fill soils are moderately plastic and are considered moderately expansive. These soils are subject to moderate volumetric change with changes in soil moisture content which can cause movement and distress to lightly loaded floor slabs and pavements. The most severe problems occur where higher clay content soils (CL-CH) are in a natural state of low moisture or are highly compacted at moisture contents near or below optimum moisture content on a relatively incompressible base. Subsequent moisture content increases below the floor slab or pavement after construction then cause the moderately expansive soils to swell appreciably. If the moisture content does not fluctuate much, then the soil swelling and heave will be minor.

Based on the FFE of 153.0 feet, moderately expansive soils will be present directly beneath the floor slab near Boring Nos. 3 and 4. A local common technique to reduce future shrink/swell problems is to separate pavements and floor slabs from expansive soils with a minimum 1 and 2 feet thick low plasticity buffer, respectively. The buffer provides more dead load to resist heaving and reduces moisture fluctuations in the expansive soils. Thicker buffers provide more protection. Over-excavation of expansive soil under movement sensitive elements is commonly required to accommodate the low plasticity buffer. This buffer can be composed of several different materials including:

1. Naturally occurring low plasticity cohesive soils with Liquid Limits (LL) of 45 or less and Plasticity Indexes (PI) of 23 or less. Portions of the lean clay (CL) existing fill and deeper on-site sandy lean clay (CL) portions of the glacial till soils satisfy this criteria.
2. Granular or cohesionless materials including crushed limestone or recycled concrete aggregate. The granular subbase under floor slabs is considered part of the low plasticity buffer.

3. On-site expansive soils can be chemically stabilized and function as a low plasticity buffer. Our experience indicates that a treatment rate of about 15 to 18 percent Class C fly ash, 6 to 8 percent dolomitic quicklime, or 3 to 5 percent Portland cement by the soil’s maximum dry density as determined by Standard Proctor (ASTM D698) is required to adequately stabilize the expansive soils. A rotary pulvamixer should be used to fully incorporate the selected chemical stabilizer into the soil.

Typical movements due to moderately expansive soils (CL-CH) are similar to movements that pavements commonly experience from frost heave. Considering that proposed pavements will be subject to frost heave movements, the risk of movement due to moderately expansive soils may be acceptable to the owner. If the owner chooses to accept the risk of possible future expansive soil movements, we recommend pavements be supported on 1 foot or more of prepared compacted subgrade further discussed in the *Pavement Subgrade Preparation* section of this report. Subgrade condition and moisture content should be maintained until the slabs or pavements are placed. If the soil is allowed to dry prior to slab or pavement placement, the risk of future slab movement would then increase. If the owner prefers to take a more proactive approach to reduce pavement movement due to expansive soils, pavements could bear on 1 foot or more of low plasticity cohesive (Liquid Limit of 45 or less and Plasticity Index of 23 or less), chemically stabilized on-site plastic soils, or cohesionless soils, such as drained crushed rock similar to Iowa DOT 4123 Modified Subbase.

Newly planted vegetation (trees and shrubs) or the existing vegetation currently growing close to the proposed building remove moisture from the nearby soils. Foundations and floor slabs can potentially settle due to shrinkage of soils beneath the footings and floor slabs as the soils dry, especially during drought periods when mature trees withdraw moisture from nearby soils. As a rule of thumb, trees and shrubs should be kept a minimum horizontal distance away from the building equal to the ultimate height of the vegetation. Likewise, excessive irrigation next to the building can contribute to soil swelling and should be avoided.

**Site Grading**

To achieve a finish floor elevation (FFE) of 153.0 feet, we estimate cut depths of 2 feet or less and new fill thicknesses of up to 6 feet will be required to achieve desired grades below the building. Deeper cuts of up to 8 feet will be required for the dry detention basin south of the proposed fire station. Shallower detention basins on the order of 3 feet deep are planned on the east and northwest corners of the property.

Prior to the placing of concrete floors or pavements on this site, or before any fill is placed, the organic and loose materials in addition to all vegetation and pavements must be stripped after
the buildings have been demolished. We expect that a minimum stripping depth of 6 inches will be required. The stripping depths may vary due to localized variations in vegetation cover and subgrade stability. The strippings could be used for landscaping purposes in non-critical areas where support for foundations, floor slabs, and pavements is not required. Root balls from large mature trees on the north side of the site should also be completely removed. The subgrade should then be proof-rolled to delineate zones of soft soils present near the surface which may require additional removal or compaction.

We recommend that low plasticity (Liquid Limit of 45 or less and Plasticity Index of 23 or less) cohesive or cohesionless soils, free of rubble and organics, be used as compacted fill. Inorganic existing soil such as the lean clay (CL) portions of the existing fill and lean clay (CL) portions of the natural Wisconsinan glacial till would be suitable soil types for general fill applications and low plasticity buffer. Lean to fat clay (CL-CH) existing fill and lean to fat clay (CL-CH) natural soils should not be present within 2 feet, preferably deeper, below the bottoms of the floor slabs.

The following Table A lists recommended minimum compaction requirements for cohesive and cohesionless fill materials in specific applications. For cohesive soils, moisture contents within a range of -1 to +4 percent of the material's optimum moisture content are necessary to achieve the desired fill qualities. Soil compacted closer to its optimum moisture content will exhibit greater stability under repeated construction traffic.

The on-site soils can be excavated utilizing conventional excavation equipment. Granular soils can generally be suitably compacted with vibratory compaction equipment whereas cohesive soils are more suitable for compaction with sheepfoot or pneumatic type compactors. Care should be exercised in properly backfilling and compacting all trenches, especially utility trenches under or adjacent to the pavement. Loosely compacted or sand backfilled trenches can collect surface water and inadvertently direct it to the pavement subgrade and cause softening of the soil as well as increasing frost heave potential.

At the time of this geotechnical exploration, moisture contents of the existing fill and upper portions of the Wisconsinan glacial till deposits were generally near or to slightly above the recommended moisture content range for compaction. Depending upon precipitation levels prior to and during construction, adjustment of soil moisture content may be required in order to lower or raise the moisture to within the recommended moisture content range. Discing and aeration is generally the most economical method to lower soil moisture content, if climatic conditions allow. Chemical modification (drying) of very moist soils with Class C fly ash, Portland cement, or quicklime can be accomplished if construction scheduling does not permit field drying. Common chemical modification methods may not be reactive when temperatures are near or below 40° Fahrenheit if grading or fill placement at the site will be conducted during colder weather.
TABLE A
RECOMMENDED DEGREE OF COMPACTION GUIDELINES

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>95%</td>
<td>98%</td>
<td>70%</td>
</tr>
<tr>
<td>Class 2</td>
<td>90%</td>
<td>93%</td>
<td>45%</td>
</tr>
<tr>
<td>Class 3</td>
<td>85%</td>
<td>88%</td>
<td>20%</td>
</tr>
</tbody>
</table>

Class 1 - Subgrade for building foundations, slabs-on-grade, pavements and other critical backfill areas.
Class 2 - Backfill adjacent to structures not supporting other structures - Minor subsidence possible.
Class 3 - Backfill in non-critical areas - Moderate subsidence possible.

*Use Relative Density technique (ASTM D4253 & D4254) where Standard Proctor technique (ASTM D698) does not result in a definable maximum dry density and optimum moisture content.

Cut Slope Stability and Subsurface Drainage

The Grading Plan indicates cut depths of 8 feet are planned on the south side of the site for south detention basin. Shallower cut depths on the order of 3 feet are planned for the east and northwest detention basins. Cut slopes constructed at 3:1 (H:V) or flatter in the majority of on-site cohesive soil types encountered are generally stable if not subject to moisture seepage. Sand, if present and left unprotected on an exposed slope, will be subject to erosion. In areas where encountered on exposed slopes during site grading, we recommend the sand be covered with a minimum of one foot of cohesive soil in order to reduce the potential for surface erosion. The on-site cohesive soils could be used for soil cover. Where moisture seepage is encountered during earthwork operations or where cuts extend below the seasonal high groundwater table, it may be necessary to install subsurface drainlines uphill of the potential seepage areas in order to intercept groundwater before it exits the slope which may not become evident until exposed at time of construction. The following Figure No. 2 depicts a typical interceptor drainline cross-section. Ongoing, unmitigated moisture seepage on the slopes can lead to erosion, sloughing, and wet areas that can be difficult to maintain.
Excavation Stability and Dewatering

Boring information indicates excavations at the site will encounter predominately cohesive soils with the possibility of wet sand seams or glacial outwash layers within the Wisconsinan glacial till. Although not encountered in the borings, granular fill materials may also be present in other unexplored areas. If excavations encounter only cohesive soils with no wet sand seams or layers, it is expected that the water seepage can be controlled by permitting it to drain into temporary construction sumps and be pumped outside the perimeter of the excavations. More extensive dewatering such as sand points and wells may be required for excavations which extend down into water bearing sand layers. We recommend that prior to excavating in saturated sand, water levels be lowered and maintained 2 feet or more below the bottom of excavations to prevent upward seepage forces which could reduce subgrade support.

The extent of bracing or sloping of open cut excavations will be dependent upon depth of cut, groundwater conditions, soils encountered, length of time the excavation will be open, area available for excavation and local governing regulations. Predominately cohesive soils may appear to stand nearly vertical in shallow excavations for short periods of time. However, soil creep, surcharge loads, precipitation, subsurface moisture seepage, construction activity vibrations and other factors may cause these soils to cave within an unpredictable period of time. Excavations encountering sand may tend to cave rapidly, especially if water is flowing through the sand. Unstable granular excavation walls may also cause surrounding cohesive soils to become unstable.

Temporary shoring, flattening of the excavation slopes or use of trench boxes may be required to maintain a safe condition. Determining the appropriate OSHA classifications of the soil types encountered and implementing the required provisions for sloping, shoring, and bracing of excavations throughout the project during construction are the responsibility of the contractor per OSHA.
**Deep Fill and Settlement Waiting Period**

It is our understanding, up to 6 feet of new fill will be placed at this site to achieve desired final grades. The upper softer portion of the natural glacial till soils will consolidate under the weight of new fill causing general area settlement. Our estimates indicate that new compacted fill sections up to 6 feet thick could cause total settlements on the order of 1 inch. Sources contributing to differential settlement include differential area fill thicknesses beneath the proposed structures, varying thicknesses of compressible soils below new footings and floors, and varying building loads or footing widths.

New footings, floor slabs, and pavements could experience movement if the majority of consolidation settlement has not occurred prior to construction of the settlement sensitive elements. To reduce potential settlement and cracking, we recommend a waiting period after the fill of at least 2 weeks prior to constructing footings, floor slabs and pavements. Depending upon the construction schedule, settlement monuments could be installed and monitored to more closely determine when settlement has essentially complete. Construction could be ongoing in other areas of the building or site where less than 5 feet of new fill has been placed.

**Foundation Design**

With a proposed building finish floor near elevation 153.0 feet, we assume that exterior frost-depth footings will bear approximately 4 feet below finish floor, near elevation 149 feet, and interior footings may bear at shallower depths of about 2 feet, near elevation 151 feet. Considering past projects of similar size, the new structure is assumed to generate light to moderate structural loads, i.e. maximum continuous wall loads of 5 kips per lineal foot or less and maximum isolated column loads of 100 kips or less.

In our opinion, newly placed engineered compacted fill required to replace the existing fill and suitable stiff natural soils can provide adequate support for the proposed structure. We recommend continuous and isolated spread foundations bearing on new engineered compacted fill or stiff natural soils be proportioned for maximum net allowable bearing pressures of 2,000 and 2,500 pounds per square foot (psf), respectively.

Softer natural glacial till soils were encountered near the assumed exterior footing level in Boring No. 4 conducted in the proposed parking lot. If similar soft soils are encountered during footing excavation, footings should be extended to bear on firmer soils or an over-excavation and compacted backfill procedure should be implemented. A layer of coarse clean crushed rock may be necessary at the bottom of the over-excavation to facilitate compaction of subsequent backfill lifts if soft soils are encountered. Over-excavations should extend 9 inches laterally in each direction beyond the foundation edges for each foot of over-excavation depth as shown in the following Figure No. 3. Observations and test probing of the foundation subgrade soils should be
conducted by an ABE geotechnical engineer to determine that the soils are compatible with the design criteria.

We estimate long-term total settlement due to structural loads will be less than 1 inch and differential settlement of similarly loaded footings may be on the order of \( \frac{1}{2} \) of the total settlement when foundations bear on newly placed engineered compacted fill and suitable stiff natural soils.

Continuous foundations should be adequately reinforced to limit deflections caused by non-uniform soil support characteristics. All exterior foundations and foundations in unheated areas should be placed a minimum of 3.5 feet below final grade to provide protection against frost penetration and reduce movements associated with changes in soil moisture content. The on-site primarily cohesive soils and newly placed cohesive fill would be suitable for trench foundations. Granular soils encountered in excavations should be expected to cave. Footing excavations should be kept free of water accumulation to prevent softening of subgrade soils.

![Figure No. 3 – Over-Excavation and Compacted Backfill Procedure](image)

**Seismic Site Classification**

Boring No. 3 was conducted to a depth of 58.8 feet where it terminated in a layer of very hard limestone bedrock. Water well logs in the area on file with the Iowa Department of Natural Resources (IDNR) indicate that hard bedrock continues to a depth of 100 feet and deeper below existing grades. Based on the overburden soils and bedrock profile and Table 20.3-1 Site Class Definitions of the 2010 ASCE-7 Standard, we interpret that the soil profile at this site would be classified as Site Class C. From the 2015 International Building Code Figures 1613.3.1 (1) and (2), Tables 1613.3.3 (1) and (2) we interpret the structural seismic design site coefficients for
mapped spectral response acceleration at short period ($F_a$) equal to 1.2 and at 1-second ($F_v$) equal to 1.7.

**Lightly and Heavily Loaded Floor Slab Support**

Lightly loaded interior floor slabs can be adequately supported on a minimum of 1 foot of reworked inorganic low plasticity (LL ≤ 45, PI ≤ 23) existing soils, 1 foot or more of low plasticity engineered compacted fill required to achieve desired grades, and 2 feet of new engineered compacted fill required to remove moderately expansive soils. Lightly loaded floor slabs can be designed for a modulus of subgrade reaction value of 100 pounds per cubic inch (pci) when bearing on the above recommended subgrades.

The heavily loaded floors in the apparatus bays may be up to 8 inches thick and have trench drains to collect truck runoff. Existing and final grades in this area indicate these heavily loaded floor slabs will be supported on 2 feet or more of new engineered compacted fill required to achieve desired grades and to remove existing fill soils. Heavily loaded floor slabs supported on 2 feet or more of new engineered compacted fill can be designed for a modulus of subgrade reaction value of 125 pci. If 1 foot of compacted crushed rock is used beneath the apparatus bay floor slab then a higher modulus of subgrade reaction of 150 pci could be used.

Testing, observations and probing should be conducted during construction to delineate zones of soft soils which may require repair prior to concrete placement.

**Lateral Earth Pressures**

Walls constructed to retain soil should be designed to accommodate unbalanced lateral earth pressures. Estimated lateral earth pressures for cohesive and cohesionless (granular) backfill are presented in the following Table B. Active earth pressure design assumes that the wall can rotate and deflect at the top. If the wall is rigidly fixed, higher lateral earth pressures will develop against the wall and at-rest pressure parameters should be used for design. Increased earth pressures can also develop from restricted soil drainage, surcharge loads adjacent to the wall, and compaction of the adjacent backfill. Expansive materials (CH), either natural or backfill, should not be within 3 feet of below grade walls.

A coefficient of sliding friction value of 0.3 may be used for P.C. concrete on a cohesive subgrade. This ultimate value assumes no safety factor and design with this ultimate value should include a minimum factor of safety of 1.5.

Cohesionless (granular) backfill lateral earth pressure parameters may be used where granular backfill is installed behind the subsurface wall in accordance with the following Figure No. 4. The granular backfill should have a minimum width of 2 feet and be wide enough to accommodate the back slope limit line of 2:1 (vertical to horizontal) or flatter. The area between
the required minimum zone of granular material and the actual limits of excavation may be backfilled with either cohesive or granular soils.

**TABLE B**

**LATERAL EARTH PRESSURE PARAMETERS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cohesive Soil (non-expansive clay)</th>
<th>Cohesionless Soil (granular-sand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assumed Backfill Characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approximate Total Density</td>
<td>130 pcf</td>
<td>120 pcf</td>
</tr>
<tr>
<td>Approximate Friction Angle</td>
<td>15° - 20°</td>
<td>30° - 35°</td>
</tr>
<tr>
<td>Active Pressure Coefficient, $K_a$</td>
<td>0.5</td>
<td>0.3</td>
</tr>
<tr>
<td>At-Rest Pressure Coefficient, $K_o$</td>
<td>0.7</td>
<td>0.5</td>
</tr>
<tr>
<td>Passive Pressure Coefficient, $K_p$</td>
<td>2</td>
<td>3.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Estimated Lateral Earth Pressure$^1$ (Equivalent Fluid Pressures)</th>
<th>Cohesive Soil (non-expansive clay)</th>
<th>Cohesionless Soil (granular-sand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active - Drained</td>
<td>65 pcf</td>
<td>35 pcf</td>
</tr>
<tr>
<td>Active - Undrained$^2$</td>
<td>95 pcf</td>
<td>80 pcf</td>
</tr>
<tr>
<td>At-Rest - Drained</td>
<td>90 pcf</td>
<td>60 pcf</td>
</tr>
<tr>
<td>At-Rest - Undrained$^2$</td>
<td>110 pcf</td>
<td>90 pcf</td>
</tr>
<tr>
<td>Passive - Drained</td>
<td>260 pcf</td>
<td>400 pcf</td>
</tr>
<tr>
<td>Passive - Undrained$^3$</td>
<td>135 pcf</td>
<td>190 pcf</td>
</tr>
</tbody>
</table>

1) Assumes no safety factor, negligible wall friction, vertical wall, level backfill, zero surcharge loads and ignores cohesion shear strength.
2) Combined buoyant backfill unit weight and hydrostatic (water @ 62.4 pcf) loading.
3) Excludes hydrostatic loading.
Walls retaining fine-grained soils, and subjected to seasonally depressed temperatures, may be subject to long-term accumulative movement due to soil creep and freeze-thaw action. It is desirable to use free draining granular backfill behind such walls to reduce this movement. We recommend that a chimney of clean granular material (similar to Iowa DOT Specification 4131) be placed directly against the back of these walls and that the chimney be connected to a drain system. An acceptable drain system may be constructed using perforated pipe encased in clean granular material and sloped to sumps or storm drains.

**Pavement Subgrade Preparation**

Uniform subgrade support is critical in pavement performance. As discussed in the *Existing Fill* section of this report, there is risk of settlement and cracking associated with constructing new pavements over existing fill encountered at this site. The risk of pavement settlement and cracking may be acceptable to the owner for economic reasons, as pavements are more easily repaired than footings and floor slabs. However, completely removing all existing fill beneath proposed pavements would provide the most reliable support.

If the owner chooses to accept the risk of future pavement settlement by constructing new pavements over existing fill, we recommend proof-rolling and technical observations be conducted by an ABE geotechnical engineer during subgrade preparation. As a minimum, we recommend that the prepared subgrade depth be at least 1 foot deep after fine grading or trimming and extend 2 feet beyond the edge of the pavements. The recommended 1 foot of compacted subgrade may necessitate undercutting and reworking soils in cut areas. Subgrade preparation to 1 foot depths
for some soil types may not be suitable under repeated heavy construction vehicle loads and may require stabilization to greater depths.

Subgrade preparation should be completed shortly before paving operations commence and is to be maintained in suitable condition until paved. Damages caused by construction traffic or deterioration due to adverse weather are to be repaired prior to paving.

Depending upon conditions encountered at the time of construction, it may be necessary to moisture condition existing soils to achieve the recommended moisture content range of -1 to +4 percent of optimum moisture content. Soils compacted closer to optimum moisture content will exhibit greater stability under construction traffic loading. Suitable cohesive soil compacted to a minimum of 95 percent of maximum dry density determined by ASTM D698 would provide a design support capability equivalent to a CBR value of 3 or a modulus of subgrade reaction value of 100 pounds per cubic inch. Subgrade compaction, moisture content and depth should be verified by an ABE representative.

**Pavement Thicknesses**

Either rigid (Portland cement concrete, PCC) or flexible (hot mix asphalt, HMA) pavement types could be constructed on the prepared cohesive subgrade. The following Table C summarizes alternate pavement thicknesses for typical lightly-loaded, moderately-loaded, heavily-loaded, and very heavily-loaded paved areas. If a minimum 6-inch thick crushed rock base (such as IDOT 4123 Modified Subbase) with drains is constructed on the compacted subgrade to support the pavement which improves long-term pavement performance, the recommended thicknesses of PCC or HMA pavement may be reduced by ½ and 1 inch, respectively. However, the 5-inch thick lightly-loaded PCC pavement section should not be reduced. A more specific pavement evaluation can be provided if traffic volume and loading information is available.

The pavement thicknesses below are considered to be typical and would require periodic maintenance. This maintenance would consist of sealing cracks/joints and replacement of isolated distressed areas. Thicker pavement sections would reduce maintenance and increase the pavement service life. Likewise, thinner sections would be expected to have a shorter service life that still may satisfy particular project needs but may require more maintenance. Other criteria which influence pavement service life include surface drainage, subsurface drainage, paving material quality, reinforcement, and joint design. Construction procedures involving placement, finishing, curing, jointing and weather protection can significantly impact pavement performance.
TABLE C
TYPICAL PAVEMENT THICKNESSES

<table>
<thead>
<tr>
<th>Traffic Volume</th>
<th>Rigid: PCC</th>
<th>Flexible: HMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightly-Loaded 4</td>
<td>5&quot; 5</td>
<td>6&quot;</td>
</tr>
<tr>
<td>Moderately-Loaded</td>
<td>6&quot;</td>
<td>7&quot;</td>
</tr>
<tr>
<td>Heavily-Loaded 6</td>
<td>7&quot;</td>
<td>8&quot;</td>
</tr>
<tr>
<td>Very Heavily-Loaded 7</td>
<td>8&quot;</td>
<td>9&quot;</td>
</tr>
</tbody>
</table>

1) PCC - Flexural strength of 550 psi
2) Doweled transverse joints are recommended for PCC sections designed to carry heavy truck traffic
3) Type A HMA - Structural coefficient of 0.44/inch
4) Automobile and 1 to 2 trucks average daily traffic.
5) Thickness reduction due to crushed rock subbase does not apply
6) Entrances, delivery areas, dumpster areas or other areas of heavier truck traffic (25 trucks or less per day).
7) Up to 100 trucks per day

Frost Heave

Key elements contributing to frost heave including freezing temperatures, available water, and fine grained frost susceptible soils are generally present at sites in Iowa. As a result, frost heave problems are generally common (and most noticeable) in pavements or sidewalks adjacent to non-frost susceptible elements such as manholes, light poles, and exterior doors or frost protected stoops. Frost heave can cause pavement cracks to develop parallel to and several feet from curbs. This generally occurs where cleared paved areas exposed to freezing temperatures heave more than adjoining paved areas insulated by piled snow. Areas cleared of snow not exposed to periodic sunshine during the winter, such as under canopies, on the north side of buildings or other shaded areas, may experience more frost heave than other sunshine exposed areas. Sometimes it is not readily apparent why frost heave problems occur at one location and not at another seemingly similar location.

While it is appropriate to implement measures to reduce frost heave such as insulation, replacing frost susceptible soils with less frost susceptible soils, void forms, sealing cracks/joints to reduce surface water infiltration, or drainage improvements (surface and subsurface), these measures may simply move the frost heave problem to a different location where preventative measures have not been implemented. Having a smooth transition between heaved and non-heaved areas is desirable, but may be difficult and/or costly to accomplish. We are available to
meet with you to discuss options for your consideration to reduce frost heave potential on this project.

**GENERAL**

The analyses and recommendations in this report are based in part upon the data obtained from the soil borings performed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations which may occur between borings or across the site. The nature and extent of such variations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

It is recommended that the geotechnical engineer be provided the opportunity to review the plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical recommendations in the design and specifications. It is further recommended that the geotechnical engineer be retained for testing and observation during earthwork and foundation construction phases to help determine that the design requirements are fulfilled.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranty, expressed or implied, is made. In the event that any changes in the nature, design or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the geotechnical engineer.

The scope of our service was not intended to include any environmental assessment or exploration for the presence of hazardous or toxic materials in the soil, surface water, groundwater or air on, below or adjacent to this site.
APPENDIX
The material types encountered during the drilling operations were recorded on field logs. The profile represented on the Boring Log is based on final classification performed by a geotechnical engineer using the field logs, laboratory observation and testing. The material stratigraphy demarcation lines shown on the Boring Logs indicate changes in soil characteristics, however, actual soil changes or variations may occur as a gradual transition. Soil profile discussion, Log Boring information, water levels and recommendations presented in this report are based upon measured depths below ground levels existing at time of the field exploration, unless otherwise specified.

**DRILLING AND SAMPLING**

The borings were conducted with either a truck or all-terrain rotary drill rig using the drilling methods indicated on each Boring Log. Soil sampling and/or in-situ testing such as Shelby Tube (ST), split-spoon (SS), drive cone (DC), or core (C) was conducted at depth intervals which were selected in consideration of the characteristics of the proposed construction. Generally undisturbed soil samples are taken at 5 foot depth intervals or change in soil types. Disturbed soil samples from the auger, either jar size or bulk size samples, may be taken at intermediate intervals for the purpose of soil classification or laboratory testing. Borings conducted for soil classification only, will show no designation of sampling although disturbed sampling is performed. Soil samples obtained in the field were identified and sealed for transportation to the laboratory for performance of pertinent physical testing and engineering classification.

**Drilling Methods**

CFA - Continuous Flight Auger: 4, 6, or 8-inch diameter (ASTM D1452).
RD - Rotary Drilling: Using drilling fluid in cased or uncased boring (ASTM D2113).
HSA - Hollow Stem Auger: 6 or 8-inch diameter, continuous flight auger remains in boring with soil removed from the hollow stem through which undisturbed sampling is conducted.
HA - Hand Auger: 4-inch or less diameter.

**Sample Types**

ST - Shelby Tube: Thin-walled tube samples of cohesive soils (ASTM D1587).
SSA - Split Spoon with 140 lb. automatic hammer: Standard penetration test and split-barrel samples (ASTM D1586).
DC - Drive Cone: Dynamic in-place testing of soil using a 2-inch diameter cone with a 60 degree point driven into the soil for continuous 1-foot intervals in the same manner as Split Spoon, no sample is obtained.
C - Core: Sampling hard soil or bedrock with a diamond core barrel in a rotary drill boring (ASTM D2113).
SPT - Standard Penetration Test: Number of blows required to drive sampler (split spoon or drive cone) into the soil with a 140-pound weight dropping a distance of 30-inches (ASTM D1586), number of blows recorded for each 6-inch interval in an 18-inch (or more) penetration depth, values shown are for each 6-inch interval (if series of number sets are shown) or a total of the last two 6-inch intervals (if only one number is shown) which is commonly referred to as "N" in blows per foot. High resistance is indicated by a high number of blows for a lesser penetration depth listed in inches.
BS - Bulk Sample: Disturbed.
CPT - Cone Penetration Test: Quasi-static in-place testing of soils using a 60 degree cone and friction sleeve which are steadily pushed into the soil and measure skin friction and end bearing (ASTM D3441).

**STANDARD LABORATORY TESTING**

Representative undisturbed soil samples obtained by the Shelby Tube sampler were tested for moisture content (ASTM D2216), density (dry) and unconfined compressive strength (ASTM D2166) in the laboratory. Results of these tests appear on the respective Boring Logs. Additional soil testing including particle size analysis (ASTM D422) and Atterberg Limits (ASTM D4318) may be conducted, if necessary, to define in more detail pertinent soil characteristics for classification in accordance with the Unified Soil Classification System. Specialized laboratory tests (if conducted) to determine pertinent soil characteristics are discussed in the "Laboratory Testing" section of the report.

**WATER LEVEL MEASUREMENT**

Water levels indicated on the Boring Logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels is not possible with short term observations.
Soil description is based on the Unified Classification System as outlined in ASTM Designations D-2487 and D-2488. This classification is primarily based upon visual and apparent physical soil characteristics, comparison with other soil samples, and our experience with the soil. Additional laboratory testing may be conducted, if necessary to define in more detail pertinent soil characteristics. The Unified Soil Classification group symbol shown on the boring logs corresponds with the group names listed below. The description includes soil constituents, moisture conditions, color and any other appropriate descriptive terms.

### Group Symbol | Group Name | Group Symbol | Group Name | Group Symbol | Group Name | Group Symbol | Group Name
--- | --- | --- | --- | --- | --- | --- | ---
GW | Well-Graded Gravel | SW | Well-Graded Sand | CL | Lean Clay | CH | Fat Clay
GP | Poorly-Graded Gravel | SP | Poorly-Graded Sand | ML | Silt | MH | Elastic Silt
GM | Silty Gravel | SM | Silty Sand | OL | Organic Clay | OH | Organic Clay
GC | Clayey Gravel | SC | Clayey Sand | PT | Peat

### Descriptive Soil Classification

- **Relative Proportions**
  - **Descriptive Term(s)** (Of components also present in sample)
  - **Sand and Gravel % of Dry Weight**
  - **Fines % of Dry Weight**
  - **Major Component of Sample Size Range**

| Trace | <15 | <5 | Cobble (12 in. to 3 in. (300mm to 75mm)) |
| With | 15-30 | 5-12 | Gravel (3 in. to #4 sieve (75mm to 4.75mm)) |
| Modifier | >30 | >12 | Sand (#4 to #200 sieve (4.75mm to 0.074mm)) |
| | | | Silt or Clay (Passing #200 sieve (.074 mm)) |

### Grain Size Terminology

- **Major Component of Sample**
- **Size Range**

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Unconfined Compressive Strength, Qu, psf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Soft</td>
<td>&lt; 500</td>
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<tr>
<td>Soft</td>
<td>500-1,000</td>
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<tr>
<td>Medium Stiff</td>
<td>1,000-2,000</td>
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<td>Stiff</td>
<td>2,000-4,000</td>
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<tr>
<td>Very Stiff</td>
<td>4,000-8,000</td>
</tr>
<tr>
<td>Hard</td>
<td>8,000-16,000</td>
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<tr>
<td>Very Hard</td>
<td>&gt; 16,000</td>
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<tr>
<th>Relative Density</th>
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<tr>
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<td>30-50</td>
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<tr>
<td>Very Dense</td>
<td>50-80</td>
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<tr>
<td>Extremely Dense</td>
<td>80+</td>
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### ABBREVIATIONS

<table>
<thead>
<tr>
<th>COMMONLY USED ABBREVIATIONS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ft. or ’ - feet</td>
<td>elev. - Elevation</td>
</tr>
<tr>
<td>in. or &quot; - inches</td>
<td>% - Percent</td>
</tr>
<tr>
<td>psf - pounds per square foot</td>
<td>No. - Number</td>
</tr>
<tr>
<td>plf - pound per lineal foot</td>
<td>TB - Test Boring</td>
</tr>
<tr>
<td>pcf - pounds per cubic feet</td>
<td>N - blow count (SPT, bpf)</td>
</tr>
<tr>
<td>kip - 1000 pounds</td>
<td>USCS - Unified Soil Classification System</td>
</tr>
<tr>
<td>ksf - 1000 pounds per square foot</td>
<td>LL - Liquid Limit</td>
</tr>
<tr>
<td>klf - 1000 pounds per lineal foot</td>
<td>PL - Plastic Limit</td>
</tr>
<tr>
<td>tsf - tons per square foot</td>
<td>PI - Plasticity Index</td>
</tr>
<tr>
<td>bpf - blows per foot (SPT, N)</td>
<td></td>
</tr>
</tbody>
</table>
### Boring Log No. 1

**Project:** Des Moines Fire Station No. 11  
4144 Hubbell Avenue  
Des Moines, Iowa

**Client:** City of Des Moines  
400 Robert D. Ray Drive  
Des Moines, IA 50309

**Surface Elevation:** 148.8'  
**Datum:** IOWA RTN DERIVED

**Date Drilled:** 4/5/2019  
**Drilling Method:** 4” CFA

**Drilling Depth, ft.:** 20  
**Page:** 1 of 1

---

**Material Description**

<table>
<thead>
<tr>
<th>Elevation (ft)</th>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Type</th>
<th>SPT bpf</th>
<th>Moisture Content, %</th>
<th>Dry Density pcf</th>
<th>Unconfined Compressive Strength psf</th>
</tr>
</thead>
<tbody>
<tr>
<td>145</td>
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<td>5</td>
<td>SSA</td>
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<td>140</td>
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<td>20.1</td>
<td></td>
<td></td>
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<tr>
<td>135</td>
<td>15</td>
<td>3</td>
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</table>

*The stratification lines represent the approximate boundary lines between material types: in-situ, the transition may be gradual.*

**WISCONSINAN GLACIAL TILL**

- Dark gray after 14'
- Sand seam near 18.5'
- Moist after 9'
- Moisture seepage near 7'

**Fill**

- Very dark brown and brown sandy lean clay, trace gravel, moist

**End of Boring**

---

**Time:** at completion 72 hrs. days

**Depth to water:** 12 ft. **-6.8** ft. **-** ft. **-** ft. **-** ft.
**BORING LOG NO. 2**

**NORTHING** 596172.1  **EASTING** 1631461.0  **Project No.:** 191104

**Project:** Des Moines Fire Station No. 11  
4144 Hubbell Avenue  
Des Moines, Iowa

**Client:** City of Des Moines  
400 Robert D. Ray Drive  
Des Moines, IA 50309

**Surface Elevation:** 149.7'  
**Datum:** IOWA RTN DERIVED

**Date Drilled:** 4/5/2019  
**Drilling Depth, ft.:** 20  
**Drilling Method:** 4" CFA  
**Page:** 1  
**Client:** City of Des Moines  
400 Robert D. Ray Drive  
Des Moines, IA 50309

---

**Material Description**

<table>
<thead>
<tr>
<th>Elevation ft.</th>
<th>Depth ft.</th>
<th>Sample No.</th>
<th>Type</th>
<th>SPT bpf</th>
<th>Moisture Content %</th>
<th>Dry Density pcf</th>
<th>Unconfined Compressive Strength psf</th>
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<td>SSA</td>
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<td></td>
<td></td>
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<td>SSA</td>
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<td>5</td>
<td>SSA</td>
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<td>18.7</td>
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</tr>
<tr>
<td>130</td>
<td>20</td>
<td>6</td>
<td>ST</td>
<td></td>
<td>17.2</td>
<td>109</td>
<td>3340</td>
</tr>
</tbody>
</table>

**WISCONSINAN GLACIAL TILL**

- Dark gray after 14.5'
- End of Boring

---

**Time:** at completion  72 hrs.  72 days

**Depth to water:** CW19' ft.  -6.5 ft.  ______ ft.  ______ ft.  ______ ft.

---

**ALLENDER BUTZKE ENGINEERS, INC.**

Geotechnical  |  Environmental  |  Construction Q.C.
**BORING LOG NO. 3**

**NORTHING 596103.4  EASTING 1631520.4**

**Project:** Des Moines Fire Station No. 11
4144 Hubbell Avenue
Des Moines, Iowa

**Client:** City of Des Moines
400 Robert D. Ray Drive
Des Moines, IA 50309

**Surface Elevation:** 155.1
**Datum:** IOWA RTN DERIVED
**Date Drilled:** 4/8/2019
**Drilling Depth, ft.:** 58.8
**Drilling Method:** 4” CFA & HSA

---

**Material Description**

- **HMA (4”±)**
  - Dark brown and brown sandy lean to fat clay, trace gravel, moist
  - **SPT bpf** 2670
  - **Dry Density pcf** 2270

- **PCC (6”±)**
  - Very dark brown lean clay, moist
  - **SPT bpf** 2270
  - **Dry Density pcf** 1920

- **FILL**
  - Brown-gray lean clay, trace sand after 5.5'
  - Sandy lean clay, trace gravel after 8'

- **WISCONSINAN GLACIAL TILL**
  - Dark gray lean clay, moist to very moist
  - **SPT bpf** 27
  - **Dry Density pcf** 128.1

- **LOESS**
  - Gray sandy lean to fat clay, trace gravel, moist
  - **SPT bpf** 38
  - **Dry Density pcf** 17.1

- **PRE-ILLINOIAN GLACIAL TILL**
  - Brown after 43'
  - **SPT bpf** 50
  - **Dry Density pcf** 105.1

- **WEATHERED BEDROCK**
  - Gray limestone, damp
  - **SPT bpf** 58
  - **Dry Density pcf** 97.1

---

**End of Boring**

---

**Time:** at completion
**Depth to water:** 20 ft.

---

**ALLENDER BUTZKE ENGINEERS, INC.**
Geotechnical | Environmental | Construction Q.C.
**BORING LOG NO. 4**

**Client:** City of Des Moines
400 Robert D. Ray Drive
Des Moines, IA 50309

**Surface Elevation:** 155.4'
**Datum:** IOWA RTN DERIVED

**Date Drilled:** 4/5/2019
**Drilling Method:** 4" CFA
**Drilling Depth, ft.:** 15

### Material Description*

**Very dark brown sandy lean clay, trace gravel, moist (LL=44, PI=26)**

**Dark brown sandy lean to fat clay, trace gravel, moist**
Brown after 5’
Brown-gray sandy lean clay after 6.5’

**Moisture seepage after 9’**

**WISCONSINAN GLACIAL TILL**

**End of Boring**

---

*The stratification lines represent the approximate boundary lines between material types: in-situ, the transition may be gradual.

---

**Time:** at completion 56 hrs. days

**Depth to water:**

- **Dry ft.** 7.8 ft.
- **Unconfined Compressive Strength psf:**
- **Unconfined Compressive Strength psf:**

---

**Geotechnical | Environmental | Construction Q.C.**

---

**ALLENDER BUTZKE ENGINEERS, INC.**

---

*The stratification lines represent the approximate boundary lines between material types: in-situ, the transition may be gradual.*
BORING LOG NO. 5  NORTHING 596173.8  EASTING 1631399.1 Project No. 191104

Project:  Des Moines Fire Station No. 11
4144 Hubbell Avenue
Des Moines, Iowa

Client:  City of Des Moines
400 Robert D. Ray Drive
Des Moines, IA 50309

Date Drilled:  4/5/2019  Drilling Method:  4" CFA

Surface Elevation:  151.4'  Datum:  IOWA RTN DERIVED

Drilling Depth, ft.:  15

---

Material Description*

<table>
<thead>
<tr>
<th>Elevation ft.</th>
<th>Depth, ft.</th>
<th>Sample No.</th>
<th>Type</th>
<th>SPT bpf</th>
<th>Moisture Content, %</th>
<th>Dry Density, pcf</th>
<th>Unconfined Compressive Strength, psi</th>
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<td>ST</td>
<td>17.6</td>
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<td></td>
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<td>150</td>
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<td>18.4</td>
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<tr>
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<td>SSA</td>
<td>9</td>
<td>15.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Estimated with hand calibrated penetrometer

---

*The stratification lines represent the approximate boundary lines between material types: in-situ, the transition may be gradual.
SECTION 01 10 00
SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Work covered by the Contract Documents.
   2. Work under other contracts.
   3. Use of premises.
   4. Owner's occupancy requirements.
   5. Specification formats and conventions.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Des Moines Fire Station No. 11, Activity ID 10-2019-001.
B. Project Location: 5044 East 42nd Street, Des Moines, IA
C. Owner: City of Des Moines/Fire Department
   1. Owner's Representative: Tim Brady
D. Architect: SVPA Architects Inc., 515.280.2419, j-ridgely@svpa-architects.com
E. The Work consists of the following: New fire station of approximately 16,000 g.s.f. located on a
   three-acre site on the northwest corner of East 42nd Street and Hubbell Avenue. The project is
   intended to be LEED certified.
F. Project will be constructed under a single prime contract.

1.3 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried
   out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work
   of this Contract with work performed under separate contracts.

1.4 USE OF PREMISES

A. General: Contractor shall have full use of premises for construction operations, including use of
   Project site, during construction period. Contractor's use of premises is limited only by Owner's
   right to perform work or to retain other contractors on portions of Project.
B. Use of Site: Limit use of premises to indicated. Do not disturb portions of Project site beyond
   areas in which the Work is indicated.

1.5 OWNER'S OCCUPANCY REQUIREMENTS

A. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
B. 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.
C. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.6 WORK RESTRICTIONS

A. Nonsmoking Building and Campus: Smoking is not permitted within the building or on campus in accordance with Owner policies and the Iowa Smoke Free Air Act.
   1. Any fees or fines imposed for failure to comply with these regulations/laws are to be reimbursed to the Owner by the contractor.

1.7 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 33-division format and CSI/CSC's "MasterFormat" numbering system.
   1. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
   2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
      a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00
SECTION 01 23 00
ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS
A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if 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. 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.

1.3 PROCEDURES
A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. 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 modifications to alternates.

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

D. 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

3.1 SCHEDULE OF ALTERNATES (TBD – may not be used)
A. Alternate No. 1: State the amount (add or deduct)

B. Alternate No. 2: State the amount (add or deduct)

END OF SECTION 01 23 00
SECTION 01 26 00
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Architect-created form.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue, through contract administration website, 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. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.

2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

b. 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.

c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

d. Include costs of labor and supervision directly attributable to the change.

2. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect through Contract administration website.

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 Division 01 Section "Product Requirements" if the proposed
change requires substitution of one product or system for product or system specified.


1.4 CHANGE ORDER PROCEDURES

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

1.5 CONSTRUCTION CHANGE DIRECTIVE


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 01 26 00
PART 1 - GENERAL

1.1 SUMMARY

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

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including Application for Payment forms with Continuation Sheets.

2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven Insert number days before the date scheduled for submittal of initial Applications for Payment.

3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the 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. Submit draft of AIA Document G703 Continuation Sheets.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

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

8. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
1.3 APPLCIATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

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

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

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include itemized amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit one electronic notarized original copies of each Application for Payment to Architect by a method ensuring receipt. Include waivers of lien and similar attachments if required.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of Values.
   3. Contractor's Construction Schedule (preliminary if not final).
   4. Submittals Schedule (preliminary if not final).
   5. List of Contractor's staff assignments.
   7. Copies of building permits.
   11. Certificates of insurance and insurance policies.

H. Application for Payment at Substantial Completion: After issuing 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.

I. Final Payment Application: 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."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00
SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Coordination Drawings.
   2. Project meetings.
   3. Requests for Interpretation (RFIs).

1.2 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.3 COORDINATION

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 with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.
   4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors 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.
   9. Project closeout activities.
1.4 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
   1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
      a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      b. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
   2. Submit through Contract administration website.
   3. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

1.5 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: Record significant discussions and agreements achieved. Distribute the meeting minutes through Contract administration website, within 5 days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
   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. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for RFIs.
      g. Procedures for testing and inspecting.
      h. Procedures for processing Applications for Payment.
      i. Distribution of the Contract Documents.
      j. Submittal procedures.
      k. Preparation of Record Documents.
      l. Use of the premises and existing building.
      m. Work restrictions.
      n. Owner's occupancy requirements.
      o. Responsibility for temporary facilities and controls.
q. Parking availability.
r. Office, work, and storage areas.
s. Equipment deliveries and priorities.
t. First aid.
u. Security.
v. Progress cleaning.
w. Working hours.

3. Minutes: Record and distribute meeting minutes through Contract administration website.

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

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Review of mockups.
   i. Possible conflicts.
   j. Compatibility problems.
   k. Time schedules.
   l. Weather limitations.
   m. Manufacturer's written recommendations.
   n. Warranty requirements.
   o. Compatibility of materials.
   p. Acceptability of substrates.
   q. Temporary facilities and controls.
   r. Space and access limitations.
   s. Regulations of authorities having jurisdiction.
   t. Testing and inspecting requirements.
   u. Installation procedures.
   v. Coordination with other work.
   w. Required performance results.
   x. Protection of adjacent work.
   y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present, the Architect/Engineer, and to parties who should have been present through Contract administration website.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
D. Progress Meetings:  Conduct progress meetings at biweekly intervals. Coordinate dates of meetings with preparation of payment requests.

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 conference shall be familiar with Project and authorized to conclude matters relating to the Work.

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

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

      1) Review schedule for next period.

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

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

3. Minutes: Record the meeting minutes.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present through Contract administration website.

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

1.6 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor and submitted to Construction Manager through Contract administration website. RFIs submitted by entities other than Contractor
on 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 interpretation and the following:
1. Project name.
2. Date.
3. Name of Contractor.
4. Name of Construction Manager.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. Specification Section number and title and related paragraphs, as appropriate.
8. Drawing number and detail references, as appropriate.
9. Field dimensions and conditions, as appropriate.
10. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
11. Contractor's signature.
12. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
   a. Identify each page of the attachments with the RFI number and sequential page number.

C. Architect's Action: Architect will review each RFI, determine action required, and return it through Contract administration website. Allow seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Contract Time or the Contract Sum.
   e. Requests for interpretation of Architect's actions on submittals.
   f. Incomplete RFIs or RFIs with numerous errors.
2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

D. On receipt of Architect's action, review response and notify Construction Manager and Architect within seven days if Contractor disagrees with response.

E. RFI Log: Maintained on Contract administration website.
PART 1 - GENERAL

1.1 SUMMARY

A. This 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. Submittals Schedule.
   3. Daily construction reports.
   4. Field condition reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

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

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

D. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

E. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

F. Major Area: A story of construction, a separate building, or a similar significant construction element.

G. Contract administration website: A website service designed specifically for transmitting submittals between construction team members

1.3 SUBMITTALS

A. Submittals Schedule: Maintained by Contract administration website. After completion of list of submittals by Contract administration website, Contractor is to modify the schedule by including the following:
   1. Scheduled date for first submittal.
   2. Name of subcontractor/supplier.
B. Contractor's Construction Schedule: Submit one copy of initial schedule, large enough to show entire schedule for entire construction period.

C. Daily Construction Reports: Submit at weekly intervals through Contract administration website.

D. Field Condition Reports: Submit at time of discovery of differing conditions through Contract administration website.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors both on and off of Contract administration website.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from parties 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 commencement of the Work to date of Substantial Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
   2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   4. Startup and Testing Time: Include time for startup and testing.
   5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   1. Phasing: Arrange list of activities on schedule by phase.
   2. Work under More Than One Contract: Include a separate activity for each contract.
   3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
   4. Work Restrictions: Show the effect of the following items on the schedule:
a. Coordination with existing construction.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Partial occupancy before Substantial Completion.
e. Use of premises restrictions.
g. Seasonal variations.
h. Environmental control.

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

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

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

2.2 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. Equipment at Project site.
   3. Material deliveries.
   4. High and low temperatures and general weather conditions.
   5. Accidents.
   7. Meter readings and similar recordings.
   8. Orders and requests of authorities having jurisdiction.
   9. Services connected and disconnected.
   10. Equipment or system tests and startups.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR’S CONSTRUCTION SCHEDULE

A. Contractor’s Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities.
   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 Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know
schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00
PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 ELECTRONIC SUBMITTAL PROCEDURES

A. Summary:
1. Shop drawing and product data submittals shall be transmitted to Architect in electronic (PDF) format using contract administration website, a website service designed specifically for transmittal submittals between construction team members.
2. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
3. The electronic submittal process is not intended for color samples, color charts, or physical material samples.

B. Procedures:
1. Submittal Preparation - Contractor may use any or all of the following options:
   a. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the contract administration website.
   b. Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
   c. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.
2. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
3. Contractor shall transmit each submittal to Architect using the Contract administration website.
4. Architect / Engineer review comments will be made available on the contract administration website for downloading. Contractor will receive email notice of completed review.
5. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.
6. Submit paper copies of reviewed submittals at project closeout for record purposes in accordance with Section 017800 – Closeout Submittals

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Costs:
1. General Contractor shall include the full cost of contract administration website project subscription in their proposal.
2. Internet Service and Equipment Requirements:
   a. Email address and Internet access at Contractor's main office.
   b. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.

E. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

F. Processing Time: Allow enough 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 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

G. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Include the following information on label for processing and recording action taken:
   a. Project name.
   b. Date.
   c. Name and address of Architect.
   d. Name and address of Contractor.
   e. Name and address of subcontractor.
   f. Name and address of supplier.
   g. Name of manufacturer.
   h. Submittal number or other unique identifier, including revision identifier. Example: 03 45 00-01, and 03 45 00-01R1.
   i. Number and title of appropriate Specification Section.
   j. Drawing number and detail references, as appropriate.
   k. Other necessary identification.

H. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

I. Resubmittals: Make resubmittals in same form 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.
1.4 CONTRACTOR’S USE OF ARCHITECT’S OR CONSULTANT’S CAD FILES

A. General: At Contractor’s written request, copies of Architect’s or Consultant’s CAD files may be provided at a nominal fee to Contractor for Contractor’s use in connection with Project. A completed Electronic Media File Transfer agreement (available from Architect or Consultant as appropriate) and remittance of fee need to be received before release of electronic documents. Architect and Consultant fees may vary; contact each discipline as appropriate for fee information.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

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 printed 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 written recommendations.
      b. Manufacturer’s product specifications.
      c. Manufacturer’s installation instructions.
      d. Manufacturer’s catalog cuts.
      e. Wiring diagrams showing factory-installed wiring.
      f. Printed performance curves.
      g. Operational range diagrams.
      h. Compliance with specified referenced standards.
      i. Testing by recognized testing agency.

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, unless submittal of Architect’s CAD Drawings is otherwise permitted.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Dimensions.
      b. Identification of products.
      c. Fabrication and installation drawings.
      d. Roughing-in and setting diagrams.
      e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
      f. Shopwork manufacturing instructions.
      g. Templates and patterns.
      h. Schedules.
      i. Notation of coordination requirements.
      j. Notation of dimensions established by field measurement.
      k. Relationship to adjoining construction clearly indicated.
      l. Seal and signature of professional engineer if specified.
      m. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

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. Electronic scans of color selections and samples will not be accepted.

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 appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected, retaining one sample.

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

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.
   1. Number of Copies: Submit one electronic copy in .pdf format of Product Data, unless otherwise indicated. Architect will review each submittal and will acknowledge receipt or it if it does not comply with requirements. Mark up and retain one returned copy as a Project Record Document.
   2. Certificates and Certifications: Provide a notarized 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.
   3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

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

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

D. Installer Certificates: Prepare 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.

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

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

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

H. Material Test Reports: Prepare 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.

I. Product Test Reports: Prepare written reports indicating 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.

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

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

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

M. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

N. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

O. Design Data: Prepare 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.
P. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.

Q. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
2. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.

R. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.
1. Architect will not review submittals that include MSDSs and will return them for resubmittal.

2.3 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 ARCHITECT'S ACTION

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

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

C. Informational Submittals: Architect will review each submittal and will return to acknowledge receipt or it if it does not comply with requirements.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded. END OF SECTION 01 33 00

SVPA No. 18079 SUBMITTAL PROCEDURES 01 33 00-6
Des Moines Fire Station #11 Activity ID 10-2019-001 Des Moines, IA
SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. See Divisions 02 through 49 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

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

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

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

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

F. 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 industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

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

J. 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. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

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

1.3 CONFLICTING REQUIREMENTS

A. General: 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 uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

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

1.4 SUBMITTALS

A. Qualification Data: 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.

B. Reports: Prepare and submit certified written reports that 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.
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.

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

1.5 QUALITY ASSURANCE

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

B. 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.

C. 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.

D. 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.

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

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST’s National Voluntary Laboratory Accreditation Program.

H. 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. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

J. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 49.

1.6 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.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. 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.
   1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

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

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

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

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

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

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

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

1.7 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.
PART 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. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
   2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

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

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

END OF SECTION 01 40 00
SECTION 01 42 00
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": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

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

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

1.3 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 Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

6. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
7. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
8. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
12. AIA - American Institute of Architects (The); www.aia.org.
19. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
20. ARI - American Refrigeration Institute; (See AHRI).
22. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. BIA - Brick Industry Association (The); www.gobrick.com.
32. CEA - Consumer Electronics Association; www.ce.org.
33. CFBAI - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
34. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
41. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
44. CSI - Construction Specifications Institute (The); www.csinet.org.
45. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
46. CWC - Composite Wood Council; (See CPA).
48. DHI - Door and Hardware Institute; www.dhi.org.
49. ECA - Electronic Components Association; (See ECIA).
50. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
52. EIA - Electronic Industries Alliance; (See TIA).
54. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
61. GS - Green Seal; www.greenseal.org.
63. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
64. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
67. IAS - International Accreditation Service; www.iasonline.org.
68. ICBO - International Conference of Building Officials; (See ICC).
70. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
71. IICRI - International Concrete Repair Institute, Inc.; www.icri.org.
73. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
74. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
75. IESNA - Illuminating Engineering Society of North America; (See IES).
76. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
77. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
79. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
80. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
81. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
82. ISO - International Organization for Standardization; www.iso.org.
83. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
84. ITU - International Telecommunication Union; www.itu.int/home.
85. LMA - Laminating Materials Association; (See CPA).
86. MCA - Metal Construction Association; www.metalconstruction.org.
96. NCMA - National Concrete Masonry Association; www.ncma.org.
98. NECA - National Electrical Contractors Association; www.necanet.org.
100. NEMA - National Electrical Manufacturers Association; www.nema.org.
102. NFPA - NFPA International; (See NFPA).
105. NLGA - National Lumber Grades Authority; www.nlga.org.
111. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
112. PCI - Precast/Prestressed Concrete Institute; www pci.org.
113. PDI - Plumbing & Drainage Institute; www.pdionline.org.
117. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
118. SDI - Steel Deck Institute; www.sdi.org.
119. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
120. SJI - Steel Joist Institute; www.steeljoist.org.
121. SMACNA - Sheet Metal and Air Conditioning Contractors’ National Association; www.smacna.org.
131. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
132. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
134. TPI - Turfgrass Producers International; www.turfgrasssod.org.
October 15, 2019

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

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
1. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
2. OSHA - Occupational Safety & Health Administration; www.osha.gov.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. USAB - United States Access Board; www.access-board.gov.
2. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00
PART 1 – GENERAL

1.1 TEMPORARY UTILITIES

A. TEMPORARY HEAT:
   1. Construction Heat Before Building Enclosures: Heat required for any portions of the building before those portions are properly enclosed, shall be provided by the Contractor requiring heat. Concrete, masonry, and site work Contractors shall provide their own heat. Heat provided includes cost of energy required.
   2. Construction Heat After Approved Building Enclosure: As the building becomes enclosed to retain heat and ventilation or cooling is required, the Contractor will provide heat from approved sources and methods.
   3. Cleaning and maintenance of permanent equipment including filter cleaning and/or changes shall be the responsibility of the HVAC contractor until substantial completion of all contracts affecting Owner's use of the building.
   4. Energy required: will be supplied by the Contractor.
   5. Contractors shall cooperate and take care that no energy is wasted.

B. VENTILATION REQUIRED FOR CONSTRUCTION:
   1. The building must be properly dried out as work progresses, particularly before interior finish is applied. If ventilation or drying by fans is required, the Contract requiring, shall supply such equipment as is required for drying for work.

C. TEMPORARY ELECTRICITY AND LIGHTING:
   1. Electrical Contractor to obtain permits and applications as required to make temporary and permanent connections from the electric distribution system and to provide temporary metering of all electric usage until Substantial Completion.
   2. General Contractor to pay all electric costs for temporary/construction electric services until substantial completion and acceptance by Owner.
   3. Electrical Contractor to install temporary circuit and branch wiring where necessary, with area distribution boxes located so that power and lighting is available throughout the use of construction-type power cords.
   4. Electrical Contractor to provide adequate artificial lighting for all areas of work when natural light is not adequate for work. (5 ft. candles)
   5. Each Contractor and subcontractor shall furnish their own extension cords.

D. WATER SERVICE
   1. Plumbing Sub-contractor shall make available water from new water service. The Contractor shall pay for such water as required for construction.

E. SANITARY CONVENIENCES
   1. General Contractor shall provide, maintain, and remove when directed, suitable temporary sanitary convenience for use of all workmen on the project. No permanent fixtures may be used for this purpose except by written direction of the Architect.

1.2 CONSTRUCTION FACILITIES

A. TEMPORARY FACILITIES
1. General Contractor shall provide, maintain, and remove when directed, suitable temporary substantial storage building or trailer upon the site, located where directed by Architect. All materials, which may be damaged by storage in the open, shall be placed in storage building immediately upon delivery.

2. Contractor shall secure approval of Architect for all other means of storing and protecting such material.

3. Contractor shall also provide and maintain a temporary field office equipped with heat, telephone, fax, and data connections, plan desk and file. All approved Shop Drawings and the approved Storm Water Pollution Prevention Plan shall be kept on file in this office. Locate where directed. Tables and chairs shall be available for Contractor meetings.

4. Contractor shall provide 6’ tall 12 ga. chain link fencing as shown on site drawings. Posts to be no more than 8’ o.c. No top or bottom rail requirements.

1.3 PROJECT IDENTIFICATION

A. PROJECT SIGN

1. Provide and install where directed by Architect.

2. Sign 4’ x 8’ as shown and detailed by Architect.

3. Sign: 3/4” MDO plywood supported on 4” x 4” posts and properly braced.

4. Paint sign on all surfaces with two coats of exterior paint and provide graphics and lettering as provided by Architect.

END OF SECTION 01 50 00
SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This 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.

1.2 DEFINITIONS

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

   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.

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

1.3 LEED DEFINITIONS

A. Environmental Product Declaration (EPD): An independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products. As a voluntary declaration of the life-cycle environmental impact, having an EPD for a product does not imply that the declared product is environmentally superior to alternatives.

   1. Obtained from product manufacturers.

B. Health Product Declaration (HPD): A standardized way of reporting the material contents of building products, and full disclosure of the health effects associated with these materials. The HPD is developed according to the directions set forth by the Health Product Declaration Collaborative.

   1. Obtained from product manufacturers.

1.4 SUBMITTALS

A. Substitution Requests are not allowed post-bid per City of Des Moines policy.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. No hazardous material as defined by the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations under that Clean Air Act to be used on the project.
B. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

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. 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 ensure compliance with the Contract Documents and to ensure 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. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer’s written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Any finished materials must be protected from the elements before, during, and after installation (until Substantial Completion).
8. Protect stored products from damage and liquids from freezing.

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: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer’s warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer’s Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that 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. Where products are accompanied by the term "match sample," sample to be matched is Architect's.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
   3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
   4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
   5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed.
   6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed that complies with requirements.
   7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system.
   8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified 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.
   10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
       a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium
b. Full Range: Where Specifications include the phrase “full range of colors, patterns, textures” or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00
SECTION 01 73 00
EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
2. Field engineering and surveying.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

1.2 SUBMITTALS

A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.3 QUALITY ASSURANCE

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: 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. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION
A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

3.3 CONSTRUCTION LAYOUT
A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and
electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

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

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

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

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

F. 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.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
   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.

H. 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.

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

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
   2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

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: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

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.
3.7 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.8 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.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00
SECTION 01 73 29
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. See Divisions 2 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.2 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 7 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
   1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
   2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building’s appearance and other significant visual elements.
   3. Products: List products to be used and firms or entities that will perform the Work.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
   6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
   7. Architect’s Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.3 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio without written approval from Structural Engineer.

B. 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.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related 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.
D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces 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.

1.4 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials 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 match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. 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.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. 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 prevent interruption to occupied areas.
3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. 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 as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. 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 possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29
SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous construction waste.
   2. Recycling nonhazardous construction waste.
   3. Disposing of nonhazardous construction waste.

B. Related Requirements:
   1. Section 04 20 00 "Unit Masonry" for disposal requirements for masonry waste.
   2. Section 31 10 00 "Site Clearing" for disposition of waste resulting from site clearing.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Disposal: Removal of construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

C. Recycle: Recovery of construction waste for subsequent processing in preparation for reuse.

D. Salvage: Recovery of construction waste and subsequent sale or reuse in another facility.

E. Salvage and Reuse: Recovery of construction waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, construction waste becomes property of Contractor.

B. Waste Management Plan: Submit plan within 14 days of date established for commencement of the Work.

1.5 INFORMATIONAL SUBMITTALS

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

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For waste management coordinator.

1.6 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.

B. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume but use same units of measure throughout waste management plan.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use the “Construction Waste Management Calculator," an example of which immediately follows this Section.

1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use forms. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
7. Savings in transportation and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS

2.1 RECYCLING RECEIVERS AND PROCESSORS

A. Subject to compliance with requirements, available recycling receivers and processors include, but are not limited to, the following:
1. Waste Connections of Iowa, Des Moines, IA
2. Metro Waste Authority, Des Moines, IA

2.2 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Construction Waste:
   a. Masonry and CMU.
   b. Lumber.
   c. Wood sheet materials.
   d. Wood trim.
   e. Metals.
   f. Roofing.
g. Insulation.
h. Carpet and pad.
i. Gypsum board.
j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
7) Wood pallets.
8) Plastic pails.

m. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
1) Paper.
2) Aluminum cans.
3) Glass containers.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. [Coordinator shall be present at Project site full time for duration of Project.]

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
3.2  **RECYCLING CONSTRUCTION WASTE, GENERAL**

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.

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

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.
   2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
   4. Store components off the ground and protect from the weather.
   5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.3  **RECYCLING CONSTRUCTION WASTE**

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
   4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:
   1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
   2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
      a. Comply with requirements in Section 32 93 00 "Plants" for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
   1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
      a. Comply with requirements in Section 32 93 00 "Plants" for use of clean ground gypsum board as inorganic soil amendment.

D. Paint: Seal containers and store by type.
3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

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

C. Burning: Do not burn waste materials.

D. Burning: Burning of waste materials is permitted only at designated areas on Owner’s property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

3.5 ATTACHMENTS

A. See file immediately following this section.

END OF SECTION 01 74 19
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<th>Material Description</th>
<th>Material Type</th>
<th>Material Stream</th>
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<th>Commingled Waste: Average Percentage of ADC Produced by the Sorting Facility (%)</th>
<th>Diverted Waste (cubic yards)</th>
<th>Percent Diverted (%)</th>
<th>Waste to Landfill (cubic yards)</th>
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For D+C projects: Total number of material streams: 0

For ND projects: Total diverted asphalt, brick, and concrete (ABC) waste (cubic yards): 0.00
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SECTION 01 77 00  
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Warranties.
   3. Final cleaning.

B. See Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.

C. See Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

D. See Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

E. See Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.

F. See Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
   8. Complete startup testing of systems.
   10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   11. Advise Owner of changeover in heat and other utilities.
   12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. 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.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit through Contract administration website. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

1.5 WARRANTIES

A. General: Confirm with Owner if hard copy warranty documents are required in addition to electronic copies posted to Contract administration website. If electronic documents only are required, disregard paragraphs 1.5.C and 1.5.D.

B. Submittal Time: Submit written warranties through Contract administration website on request
of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

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: Provide 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 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; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
   1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
m. Wipe surfaces of mechanical and electrical equipment [], elevator equipment,] and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
r. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 77 00
PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Emergency manuals.
   2. Operation manuals for systems, subsystems, and equipment.
   3. Maintenance manuals for the care and maintenance of products, materials, and finishes and systems and equipment.
B. See Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 SUBMITTALS
A. Manual: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
   1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL
A. General: Confirm with Owner if hard copy operation and maintenance documents are required in addition to electronic copies posted to Contract administration website. If electronic documents only are required, disregard paragraphs 2.1.B, 2.1.C, 2.1.D, 2.1.E.
B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.
C. Title Page: Enclose title page in transparent plastic sleeve. 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, address, and telephone number of Contractor.
   6. Name and address of Architect.
   7. Cross-reference to related systems in other operation and maintenance manuals.
D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
   1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to
Accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. 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 diskettes for computerized electronic equipment.

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

2.2 EMERGENCY MANUALS

A. General: Confirm with Owner if hard copy emergency documents are required in addition to electronic copies posted to Contract administration website. If electronic documents only are required, disregard paragraph 2.2.B.

B. Content: Organize manual into a separate section for type of emergency, emergency instructions, and emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component for fire, flood, gas leak, water leak, power failure, water outage, equipment failure, and chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.

B. Descriptions: Confirm if electronic or hard copy documents are required by Owner. Either type of document requires the following:
   1. Product name and model number.
   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 start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.

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 MANUAL

A. General: Confirm with Owner if hard copy product maintenance documents are required in addition to electronic copies posted to Contract administration website. If electronic documents only are required, disregard paragraph 2.4.B.

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

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Installer and supplier or maintenance service agent’s name, address, and telephone number.
5. Material and chemical composition.
6. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer’s written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

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

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. General: Confirm with Owner if hard copy system and equipment maintenance manual documents are required in addition to electronic copies posted to Contract administration website.

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

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

D. Manufacturers’ Maintenance Documentation: Manufacturers’ maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:

E. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions, and demonstration and training videotape if available, that detail essential maintenance procedures:

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

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

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

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

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. General: Confirm with Owner if hard copy emergency documents are required in addition to electronic copies posted to Contract administration website. If electronic documents only are required, disregard paragraphs 3.1.B through 3.1.F.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner’s operating personnel for types of emergencies indicated.

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

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

E. 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.

F. 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.

G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. See Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

C. See Divisions 02 through 49 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one set(s) of marked-up Record Prints.

B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Will be provided by Contract administration website.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
   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 prepare the marked-up Record Prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

   2. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

   3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

   4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

   5. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect.
B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
   2. Record CAD Drawings: Organize CAD 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 CAD file.
   3. Identification: As follows:
      a. Project name.
      b. Date.
      c. Designation "PROJECT RECORD DRAWINGS."
      d. Name of Architect.
      e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Submit under Closeout Tab on Contract administration website any Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble and upload to Contract administration website miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work.

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 modifications to Project Record Documents as they occur; do not wait until the 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 01 78 39
SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

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

B. See Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including 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.

1.3 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 Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

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 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:
1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.

2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.

3. Emergencies: Include instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.

4. Operations: Include startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.

5. Adjustments: Include alignments and checking, noise, vibration, economy, and efficiency adjustments.

6. Troubleshooting: Include diagnostic instructions and test and inspection procedures.

7. Maintenance: Include inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.

8. Repairs: Include diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 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. Owner will furnish an instructor to describe Owner's operational philosophy.

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

1. Schedule training with Owner with at least seven days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

END OF SECTION 01 79 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with certain prerequisites and credits needed for Project to obtain "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) Certified certification based on USGBC's LEED v4 BD+C.

1. Specific requirements for LEED are also included in other Sections.

2. Some LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.

3. A copy of the LEED Project checklist is attached at the end of this Section for information only.

a. Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.

1.3 DEFINITIONS

A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."

1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.

2. Select credits will be required to comply with the LEED version 4.1 for Building Design and Construction requirements.
   a. Location and Transportation: Access to Quality Transit
   b. Location and Transportation: Green Vehicles
   c. Materials and Resources: Responsible Sourcing of Raw Materials
   d. Indoor Environmental Quality: Low-Emitting Materials
   e. Indoor Environmental Quality: Daylight
   f. Indoor Environmental Quality: Acoustic Performance

B. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001. Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

1. "Postconsumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.

2. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or
scrap, generated in a process and capable of being reclaimed within the same process that generated it.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Review LEED requirements and action plans for meeting requirements.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Contractor is not responsible for the application for LEED certification, nor for determination of methods of achieving LEED credits unless specifically so indicated.

B. Many of the LEED credits can be achieved only through intelligent design of the project and are beyond the control of the Contractor. However, certain credits relate to the products and procedures used for construction. Therefore, the full cooperation of the Contractor and subcontractors is essential to achieving final certification.

C. The following credits require the contractor to initiate and execute tasks to ensure credit achievement. The absence of this designation does not absolve the Contractor from contributing to the achievement of other credits that are integral to the design of the project and the Contract Documents.
   1. SS Construction Activity Pollution Prevention
   2. EA Enhanced Commissioning
   3. MR Building Product Disclosure and Optimization - Environmental Product (EPD)
   4. MR Building Product Disclosure Optimization - Sourcing of Raw Materials v4.1
   5. MR Building Product Disclosure and Optimization - Material Ingredients (HPD)
   6. MR Construction Waste Management
   7. EQ Low-Emitting Materials v4.1
   8. EQ Construction Indoor Air Quality Management Plan

D. Respond to questions and requests from Architect and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the Project's LEED certification application. Document responses as informational submittals.

E. Submit documentation to USGBC and respond to questions and requests from USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the Project's LEED certification application.
   1. Document correspondence with USGBC as informational submittals.

F. The credit requirements described in this section are provided as a reference. The Contractor is responsible for compliance with the credit requirements as published by the US Green Building Council, including addenda.

1.6 ACTION SUBMITTALS

A. General: Submit additional sustainable design submittals required by other Specification Sections.
   1. A summary of required LEED submittals is indicated in Section 01 81 13.15 LEED Submittal Schedule.
   2. Complete the LEED Material Content form when indicated in Specification Sections. Fillable PDF form follows the LEED Submittal Schedule.
B. Sustainable design submittals are in addition to other submittals.
   1. If submitted item is identical to that submitted to comply with other requirements, include an additional copy with other submittal as a record copy of compliance with indicated LEED requirements instead of separate sustainable design submittal. Mark additional copy "Sustainable design submittal."

C. Sustainable Design Documentation Submittals:
   1. Environmental Product Declarations complying with LEED requirements.
   2. Documentation for products that comply with LEED requirements for multi-attribute optimization.
      a. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
   3. Sustainability reports for products that comply with LEED requirements for raw material and source extraction reporting.
   4. Documentation for products that comply with LEED requirements for leadership extraction practices. Include the following:
      a. Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
      b. Product data and certification for bio-based materials, indicating that they comply with requirements. Include statement of costs.
      d. Receipts for salvaged and refurbished materials used for Project, indicating sources and costs.
      e. Product data and certification letter from product manufacturers, indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement of costs.
      f. Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
   5. Material ingredient reports for products that comply with LEED requirements for material ingredient reporting.
   6. Documentation for products that comply with LEED requirements for material ingredient optimization.
   7. Documentation complying with Section 01 74 19 "Construction Waste Management and Disposal."
   8. Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content.
   9. Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials.
  10. Laboratory test reports for flooring, indicating compliance with requirements for low-emitting materials.
  11. Laboratory test reports for products containing composite wood or agrifiber products or wood glues, indicating compliance with requirements for low-emitting materials.
  12. Laboratory test reports for ceilings, walls, and thermal insulation, indicating compliance with requirements for low-emitting materials.
  13. Construction Indoor-Air-Quality (IAQ) Management:
      a. Construction IAQ management plan.
      b. Product data for temporary filtration media.
      c. Product data for filtration media used during occupancy.
d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.

14. IAQ Assessment:
   a. Signed statement describing the building air flush-out procedures, including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
   b. Product data for filtration media used during flush-out and occupancy.
   c. Report from testing and inspecting agency indicating results of IAQ testing and documentation showing compliance with IAQ testing procedures and requirements.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For LEED coordinator.

B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project for Divisions 3-10 plus paving and plants. Costs exclude labor, overhead, and profit.

C. Sustainable Design Action Plans: Provide preliminary submittals within 30 days of date established for the Notice to Proceed, indicating how the following requirements will be met:
   1. List of proposed products with Environmental Product Declarations.
   2. List of proposed products complying with requirements for multi-attribute optimization.
   3. List of proposed products complying with requirements for raw material and source extraction reporting.
   4. List of proposed products complying with requirements for leadership extraction practices.
   5. List of proposed products complying with requirements for material ingredient reporting.
   6. List of proposed products complying with requirements for material ingredient optimization.
   7. List of proposed products complying with requirements for product manufacturer supply chain optimization.
   8. Waste management plan complying with Section 01 74 19 "Construction Waste Management and Disposal."

D. Sustainable Design Progress Reports:
   1. Construction Waste Management: Concurrent with each Application for Payment, submit reports
   2. LEED submittal Log: maintain a current online record on a file sharing application. To be updated, at a minimum, concurrent with each Application for Payment.

1.8 QUALITY ASSURANCE

A. LEED Coordinator: Engage an experienced LEED-accredited professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to these LEED credits, the Contractor shall provide additional materials and procedures necessary to obtain LEED credits indicated.
B. At least 20 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.

C. At least 20 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting.

D. Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for responsible sourcing of raw materials.
   1. Extended Producer Responsibility Program: Products purchased from a manufacturer (producer) that participates in an extended producer responsibility program or is directly responsible for extended producer responsibility. Products meeting extended producer responsibility criteria are valued at 50% of their cost for the purposes of credit achievement calculation.

E. Recycled Content: Building materials shall have recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content for Project constitutes a minimum of 20 percent of cost of materials used for Project.
   1. Cost of postconsumer recycled content plus one-half of preconsumer recycled content of an item shall be determined by dividing weight of postconsumer recycled content plus one-half of preconsumer recycled content in the item by total weight of the item and multiplying by cost of the item.
   2. Do not include furniture, plumbing, mechanical and electrical components, and specialty items, such as elevators and equipment, in the calculation.

F. Wood products. Wood products must be certified by the Forest Stewardship Council or USGBC approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.

2.2 LOW-EMITTING MATERIALS

A. The Contractor is responsible for securing at least three points under the LEED v4.1 Building Design and Construction credit for Low Emitting Materials. A fourth point is available for exceptional performance.

B. To achieve 3 points use materials on the building interior (within the waterproofing membrane/weather barrier) that meet the low-emitting criteria of four product categories. To achieve a fourth point for exemplary performance, meet the criteria of 5 product categories.
   1. Product Categories specified to align to with Low-Emitting Criteria
      a. Paints and Coatings
      b. Flooring
      c. Wall Panels
      d. Ceilings
      e. Insulation
      f. Composite Wood
   2. Adhesives and sealants shall be low-emitting. Adhesives and sealants can be excluded from documentation of this credit.

C. Paints and Coatings: For field applications that are inside the weatherproofing system, 100% of paints and coatings shall comply with VOC content limits of authorities having jurisdiction and one of the applicable standards.
   1. California Air Resource Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings
2. South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016

D. Paints and Coatings VOC Emissions: For field applications that are inside the weatherproofing system, 75 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Adhesives and Sealants VOC Content: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
   1. Wood Glues: 30 g/L.
   2. Metal-to-Metal Adhesives: 30 g/L.
   3. Adhesives for Porous Materials (Except Wood): 50 g/L.
   4. Subfloor Adhesives: 50 g/L.
   5. Plastic Foam Adhesives: 50 g/L.
   6. Carpet Adhesives: 50 g/L.
   7. Carpet Pad Adhesives: 50 g/L.
   8. VCT and Asphalt Tile Adhesives: 50 g/L.
   9. Cove Base Adhesives: 50 g/L.
  10. Gypsum Board and Panel Adhesives: 50 g/L.
  11. Rubber Floor Adhesives: 60 g/L.
  12. Ceramic Tile Adhesives: 65 g/L.
  13. Multipurpose Construction Adhesives: 70 g/L.
  14. Fiberglass Adhesives: 80 g/L.
  15. Contact Adhesives: 80 g/L.
  16. Structural Glazing Adhesives: 100 g/L.
  17. Wood Flooring Adhesives: 100 g/L.
  18. Structural Wood Member Adhesives: 140 g/L.
  19. Single-Ply Roof Membrane Adhesives: 250 g/L.
  20. Special-Purpose Contact Adhesives (That Are Used to Bond Melamine-Covered Board, Metal, Unsupported Vinyl, Rubber, or Wood Veneer 1/16 Inch or Less in Thickness to Any Surface): 250 g/L.
  21. Top and Trim Adhesives: 250 g/L.
  22. Plastic Cement Welding Compounds: 250 g/L.
  23. ABS Welding Compounds: 325 g/L.
  24. CPVC Welding Compounds: 490 g/L.
  25. PVC Welding Compounds: 510 g/L.
  26. Adhesive Primer for Plastic: 550 g/L.
  27. Sheet-Applied Rubber Lining Adhesives: 850 g/L.
  30. Special-Purpose Aerosol Adhesives (All Types): 70 percent by weight.
  31. Other Adhesives: 250 g/L.
  32. Architectural Sealants: 250 g/L.
  33. Nonmembrane Roof Sealants: 300 g/L.
  34. Single-Ply Roof Membrane Sealants: 450 g/L.
  35. Other Sealants: 420 g/L.
  36. Sealant Primers for Nonporous Substrates: 250 g/L.
  37. Sealant Primers for Porous Substrates: 775 g/L.
  38. Modified Bituminous Sealant Primers: 500 g/L.
  39. Other Sealant Primers: 750 g/L.
F. Flooring: Flooring shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

G. Composite Wood: Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

H. Ceilings, Walls, and Thermal Insulation: Ceilings, walls, and thermal insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

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

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Comply with Section 01 74 19 "Construction Waste Management and Disposal."

3.3 CONSTRUCTION IAQ MANAGEMENT

A. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
1. Submit not less than 60 days before enclosure of building.
2. Identify potential sources of odor and dust.
3. Identify construction activities likely to produce odor or dust.
4. Identify areas of project potentially affected, especially occupied areas.
5. Evaluate potential problems by severity and describe methods of control.
6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
7. Identify measures to address the five approaches listed in the SMACNA IAQ guidelines: HVAC protection, source control, pathway interruption, housekeeping, and scheduling.
8. Ductwork cleanliness: maintain duct cleanliness to the intermediate level in accordance with SMACNA Duct Cleanliness for New Construction. Lined duct to be protected at all times, including during transportation.
9. HVAC equipment and ductwork may NOT be used for ventilation during construction unless explicitly authorized in writing by the owner and mechanical engineer. Equipment warranties will not take effect until substantial completion.
10. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 01 50 00 "Temporary Facilities and Controls," install MERV 8 filter media at each return-air inlet for the air-handling system used during construction.
   a. Replace air filters immediately prior to occupancy.
   b. Filtration media must be inspected weekly and changed bi-weekly.

3.4 IAQ ASSESSMENT

A. Air-Quality Testing: Owner will engage testing agency to perform the following:

2. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
   a. Formaldehyde: 27 ppb.
   b. Particulates (PM10): 50 micrograms/cu. m.
   c. Ozone: 0.075 ppm, according to ASTM D 5149.
   d. Total Volatile Organic Compounds: 500 micrograms/cu. m.
   e. 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
   f. Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.

3. For each sampling point where the maximum concentration limits are exceeded, take corrective action until requirements have been met.

4. Air-sample testing shall be conducted as follows:
   a. All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside-air flow rate for the occupied mode throughout the duration of the air testing.
   b. Building shall have all interior finishes installed, including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings, such as workstations and partitions, are encouraged, but not required, to be in place for the testing.
   c. Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 5000 sq. ft. For large open spaces, one sampling point per 50,000 sq. ft. may be used.
   d. Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION 01 81 13.14

Attachments:
01 81 13.14  LEED v4 Building Design & Construction Checklist
01 81 13.15  LEED Product Submittal Schedule (Materials)
## Project Name: DSM Fire Station  
### Activity ID: 10-2019-001

### Location and Transportation

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### Innovation

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**TOTALS: 110 Possible Points**

Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 to 110
### SECTION 08 13.15 LEED Product Schedule

Sections not listed have no LEED product or documentation requirements for products

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#### Note:
- The number total qualifying products specified shown at the end of each division does not be total number of points. For example: There are 4 different gypsum board manufacturers listed; only the product actually installed on the project will count toward the EPD credit.

### NUMBER SECTION NAME, PRODUCT NAME

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</table>

#### Division 01 -- General Requirements

| 01 7419 Construction Waste Management | provide plan and on-going reports | |
| 01 8113.14 Sustainable Design Requirements | provide plan | |
| Low Emitting Materials | All composite wood materials and site applied adhesives, sealants, paints and coatings applied on the interior MUST be | |

#### Division 03 -- Concrete

| 03 3000 Cast-in-Place Concrete | Y | |
| 03 3536 Polished Concrete Floors | R | |
| 03 3570 Concrete Floor Finishes | R | |
| 03 4100 Precast Structural Concrete | Y | R |

| Total qualifying products specified | 2 |

#### Division 04 -- Masonry

| 04 2000 Unit Masonry | |
| CMU | Y |
| Mortar and Grout | Y | R |
| Steel Reinforcing | Y | R |

| Total qualifying products specified | 3 |

#### Division 05 -- Metals

| 05 1200 Structural Steel Framing | Y | |
| Bull Moose HHS | Y | |
| 05 2100 Steel Joist Framing | Y | |
| 05 3100 Steel Decking | Y | R |
| 05 4000 Cold Formed Metal Framing | |
| Clark Dietrich | Y | Y | Y |
| 05 5000 Metal Fabrications | |
| Total qualifying products specified | 2 | 1 | 6 |

#### Division 06 -- Wood, Plastics, and Composites

| 06 1000 Rough Carpentry | |
| 06 1600 Sheathing | R |
| 06 4023 Interior Architectural Woodwork | |

SVPA No. 18079
Des Moines Fire Station #11
Activity ID 10-2019-001
MATERIALS SUBMITTAL SCHEDULE
Des Moines, IA
LEED V4 BD+C
01 81 13.15-1
<table>
<thead>
<tr>
<th>NUMBER</th>
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<th>HPD+</th>
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<tr>
<td></td>
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<td>Adhesives and sealants</td>
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**Division 07 -- Thermal and Moisture Protection**

|        | 07 2100 Thermal Insulation                |     |      |          |              |
|        | Foamular XPS Owens Corning                | Y Y Y |      |          |              |
|        | Owen's Corning Thermafiber                | Y Y Y R |      |          |              |
|        | 07 4100 Manufactured Metal Roof Panels    |     |      |          |              |
|        | 07 5400 Thermoplastic Membrane Roofing    |     |      |          |              |
|        | Versico TPO                               | Y Y |      |          |              |
|        | Versico Polyisocyanurate Insulation       | Y Y |      |          |              |
|        | Firestone Ultraply                        | Y Y |      |          |              |
|        | GAF and Johns Manville also meets         | Y Y |      |          |              |
|        | 07 6200 Sheet Metal Flashing and Trim     |     |      | R        |              |
|        | 07 8400 Firestopping                      |     |      | R        |              |
|        | 07 9200 Joint Sealants                    |     |      | R        |              |
|        | Total qualifying products specified       | 6   | 5   | 5        |              |

**Division 08 -- Openings**

|        | 08 1113 Hollow Metal Doors and Frames     |     |      |          |              |
|        | ASSA ABLOY Standard Hollow Frame          | Y Y R |      |          |              |
|        | Ceco Legion Polystyrene Ultrador          | Y Y Y R |      |          |              |
|        | Ceco Regent Honeycomb                     | Y Y Y R |      |          |              |
|        | Curries Polyiso 707 Block Door            | Y Y Y R |      |          |              |
|        | 08 1416 Flush Wood Doors                  |     |      | R        |              |
|        | 08 3513 Four Fold Doors                   |     |      | R        |              |
|        | 08 4113 Glazed Alum Curtainwall           |     |      | M R      |              |
|        | 08 4513 Structured Polycarbonate Panel Assemblies | | | | |
|        | 08 7100 Door Hardware                     |     |      | R        |              |
|        | McKinney mechanical hinge                 | Y Y Y |      |          |              |
|        | Rockwood K1050 Kick Plate                 | Y Y Y |      |          |              |
|        | 8200 Series Electromechanical Mortise Lock| Y Y |      |          |              |
|        | HES 1006 Series Strike                    | Y Y Y |      |          |              |
|        | Sargent 281 Closers                       | Y Y |      |          |              |
|        | Sargent 80 Series Mechanical Exit Device  | Y Y |      |          |              |
|        | 08 8000 Glazing                           |     |      | R        |              |
|        | Total qualifying products specified       | 10  | 6   | 12       |              |

**Division 09 -- Finishes**

<p>|        | 09 2116 Gypsum Wallboard                  |     |      |          |              |
|        | American Gypsum                           | Y Y Y R |      |          |              |
|        | CertainTee Gypsum Inc.                    | Y Y Y R |      |          |              |
|        | G-P Gypsum                                | Y Y Y R |      |          |              |</p>
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<tr>
<th>NUMBER</th>
<th>SECTION NAME, PRODUCT NAME</th>
<th>EPD</th>
<th>HPD+</th>
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<tr>
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<td>National Gypsum Company</td>
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<td>USG Corporation</td>
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<td>PT1 - Fiandre USA; French Gray, Fume</td>
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<td>PT2 - Daltile; Keystone, Black</td>
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<td>PT3 - Iris; Maiolica, Nero</td>
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**Division 10 -- Specialties**

10 11 00 Visual Display Surfaces

| Marker Board - Clarus; Surround, Float Metal | Y | Y | Y |
| Marker Board - Polyvision | Y | Y |
| Tack Board - Walltalkers; Tac-Wall | Y | Y |

**Total qualifying products specified**

| 10 50 10 | Solid Plastic Lockers |     |      |          |              |
| Tufftec Plastic Lockers | Y | Y |
| Lenox Plastic Lockers | Y | Y |

**Division 12 -- Furnishings**

12 2413 Roller Window Shades

| Mecho | Y |
| SWFContract | Y |
| Manual Shade Systems with EcoVeil | Y | Y |
| Mecho5/UrbanShade Manual Hardware | Y | Y |

**Total qualifying products specified**

| 22 0719 | Domestic Plumbing Insulation |     |      |          |              |
| Knauf Earthwool 1000F Pipe Insulation with ASJ+ | Y | Y |
### DEFINITIONS - NOTES

**EPD:**
As defined in SECTION 01 6000 - PRODUCT REQUIREMENTS. Twenty products have been identified as the basis of design to contribute to achievement of the LEED credit "MR Building product disclosure and optimization - environmental product declarations." Variations from the basis are acceptable so long as they meet all the other product requirements and the contractor substitutes another product in its place in order to secure the EPD credit. Documentation is required as defined in Section 01 81 13.14

**HPD+:**
As defined in SECTION 01 6000 - PRODUCT REQUIREMENTS. Twenty products have been identified as the basis of design to contribute to achievement of the LEED credit "MR Building product disclosure and optimization - material ingredients, option 1, material ingredient reporting." Products identified in this column have been confirmed to meet the requirements for a Health Product Declaration, Cradle to Cradle, Declare or Product Lens. Variations from the basis are acceptable so long as they meet all the other product requirements and the contractor substitutes another product in its place in order to secure the credit. Documentation is required as defined in Section 01 81 13.14

**Sourcing**
Products in this section contribute to the LEED credit "MR Building product disclosure and optimization - sourcing of raw materials." Documentation is required as defined in Section 01 81 13.14.

**Low Emitting**
Products in this section contribute to the LEED credit "EQ Low Emitting Materials." Documentation is required as defined in Section 01 81 13.14.

### MATERIALS SUBMITTAL SCHEDULE

#### LEED V4 BD+C

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<tr>
<th>NUMBER</th>
<th>SECTION NAME, PRODUCT NAME</th>
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**Division 2: HVAC**

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SVPA No. 18079
Des Moines Fire Station #11
Activity ID 10-2019-001
Des Moines, IA
SECTION 01 91 13
MEP COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Commissioning (Cx). Commissioning is a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meet defined objectives and criteria. The commissioning process begins at project inception (during the pre-design phase) and continues through the life of the facility. The commissioning process includes specific tasks to be conducted during each phase in order to verify that design, construction, and training meets the owner’s project requirements.

B. Commissioning Team. The members of the commissioning team consist of the contracted commissioning authority (CxA), the owner’s project manager (PM), the architect and design engineers (A/E), the mechanical contractor (MC), the electrical contractor (EC), the testing and balancing contractor (TAB), the temperature control contractor (TCC), the facility operating staff, and any other installing subcontractors or suppliers of equipment. The contracted commissioning authority is hired by the owner directly. The CxA directs and coordinates the project commissioning activities and reports to the owner. All team members work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.

1. Owner’s Project Manager (PM): Timothy Brady, City of Des Moines
2. Architect: SVPA
3. Mechanical Engineer: IMEG Corp.
4. Electrical Engineer: IMEG Corp.
5. Commissioning Authority (CxA): SystemWorks LLC

C. Statement of Purpose. Commissioning shall:

1. Verify that applicable equipment and systems are installed according to the contract documents, manufacturer’s recommendations, and industry accepted minimum standards and that they receive adequate checkout by installing contractors.
2. Verify and document proper performance of equipment and systems.
3. Verify that operation and maintenance (O&M) documentation left on site is complete.
4. Verify that the owner's operating personnel are adequately trained.

D. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

1.2 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.

B. Owner’s Project Requirements (OPR) and Basis of Design (BOD) documents are included by reference for information only.

C. The Commissioning Plan may be referenced for further information and detail regarding commissioning activities, commissioning schedule, and team member responsibilities.


E. PECI (Samples) – Portland Energy Conservation, Inc. sample forms for Pre-functional Checklists and Functional Performance Test are located at http://www.peci.org/ftguide/ftct/testdir.htm.
1.3 DEFINITIONS

A. **Acceptance.** A formal action taken by a person with appropriate provider (which may or may not be contractually defined) to declare that some aspect of the project meets defined requirements, thus permitting subsequent activities to proceed.

B. **Approval.** Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the contract documents.

C. **Basis of Design (BOD).** A document that records the concepts, calculations, decisions, and product selections used to meet the owner’s project requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

D. **Building Envelope Commissioning Authority (BECxA).** The systematic process of assuring by verification and documentation, from the design phase through construction that all building envelope systems perform and interface in accordance with the design documentation and intent, and in accordance with the Owner’s operational requirements.

E. **Checklists.** Verification checklists that are developed and used during all phases of the commissioning process to verify that the owner’s project requirements are being achieved. This includes checklists for general verification, plus testing, training and other specific requirements.

F. **Commissioning Authority (CxA).** The entity identified by the owner who leads, plans, schedules, and coordinates the commissioning team to implement the commissioning process.

G. **Commissioning Process.** A quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner’s project requirements.

H. **Commissioning Plan.** An overall plan developed by the commissioning authority that provides the structure, schedule, and coordination planning for the commissioning process.

I. **Commissioning Team.** The individuals who through coordinated actions are responsible for implementing the commissioning process.

J. **Construction Checklist.** A form created by the CxA and completed by the contractor to verify that appropriate components are correctly installed, started up and ready for functional performance testing. See also Checklists.

K. **Construction Documents (CD).** This includes a wide range of documents, which will vary from project to project depending upon the owner’s needs and with regulations, laws and countries. Construction documents usually include the project manual (specifications), plans (drawings), and general terms and conditions of the contract.

L. **Continuous Commissioning Process.** A continuation of the commissioning process well into the occupancy and operations phase to verify that a project continues to meet current and evolving owner project requirements. Continuous commissioning process activities are on-going for the life of the facility.

M. **Contract Documents.** This includes a wide range of documents, which will vary from project to project, with the owner’s needs and with regulations, laws and countries. Contract documents frequently include price agreements, construction management process, sub-contractor
agreements or requirements, requirements and procedures for submittals, changes and other construction requirements, timeline for completion, and the construction documents.

N. **Coordination Drawings.** Drawings showing the work of all trades to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and manufacturers’ dimension recommended maintenance clearances.

O. **Deferred Performance Tests.** Performance tests that are performed, at the discretion of the CxA, after substantial completion due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that disallow the test from being performed.

P. **Deficiency.** A condition in the installation or function of a component, piece of equipment, or system that is not in compliance with the contract documents.

Q. **Functional Performance Test (FPT).** A written protocol by the CxA that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems. Performance testing covers the dynamic functions and operations of equipment and systems using manual or monitoring methods. Performance testing is the dynamic testing of systems under full operation. Systems are tested under various modes, such as during low cooling loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system’s sequences of operation and components are verified to respond as the sequences state.

R. **Issue Log.** A formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the commissioning team during the course of the commissioning process.

S. **Startup.** The initial starting or activating of dynamic equipment, including completing construction checklists.

T. **Systems Manual.** A system-focused composite document that will provide the information needed for the owner to understand, operate and maintain the systems commissioned within the building during the occupancy and operations phase.

U. **TAB.** Testing, Adjusting, and Balancing.

V. **Trending.** The monitoring, by a building management system or other electronic data gathering equipment, and analyzing of the data gathered over a period of time.

W. **Vendor.** Supplier of equipment.

X. **Verification.** The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the construction documents.

1.4 **COMMISSIONING PLAN**

A. The CxA will develop the commissioning plan which shall be included in the project schedule when approved by the owner.

1.5 **COMMISSIONING DOCUMENTATION**

A. The following list summarizes the documentation submittals required of the contractors to be provided to the CxA:
1. Schedule of contractors’ tests
2. Contractor test reports
3. Final test and balance report
4. System checkout schedule
5. Sensor calibration documentation
6. Pre-functional construction checklist completion
7. Functional testing schedule
8. Corrective action documentation
9. Operation and maintenance manuals
10. Operation and maintenance training agenda and schedule

1.6 RESPONSIBILITIES

A. The general responsibilities of various parties in the commissioning process are provided in this subsection. The commissioning process does not take away from, or reduce the responsibility of the General Contractor or installing subcontractors to provide a finished and fully functioning product.

B. CM / GC Coordinator. The Construction Manager (CM) or General Contractor (GC) shall assign a qualified individual to function as the coordinator for commissioning activities. The coordinator shall have a minimum of 5 years experience in construction management. The coordinator’s responsibilities shall include but not be limited to the following:

1. Coordinate and document meetings between the CxA and construction team.
2. Schedule commissioning activities.
3. Coordinate pre-functional test completion by the construction team.
4. Coordinate O&M deliverables to CxA.
5. Coordinate and document O&M training.
6. Coordinate corrective actions generated from CxA events.
7. Assist the CxA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

C. Architect (of A/E)

1. Attend the commissioning scoping meeting and selected commissioning team meetings.
2. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
3. Provide any design narrative documentation requested by the CxA.
4. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
5. Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.

D. Mechanical and Electrical Designers/Engineers (of the A/E)

1. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted.
2. Provide any design narrative and sequence documentation requested by the CxA. Assist, along with the contractors, in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
3. Attend commissioning scoping meetings and other selected commissioning team meetings.
4. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
5. Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
6. Provide a presentation at one of the training sessions for the owner’s personnel.
7. Review and approve the pre-functional checklists for major pieces of equipment for sufficiency prior to their use.
8. Review and approve the functional performance test procedure forms for major pieces of equipment for sufficiency prior to their use.
9. Witness testing of selected pieces of equipment and systems as necessary.
10. Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

E. Owner or Owner’s Representative (PM)

1. Facilitate coordination of the commissioning activities and ensure with the CM / GC and CxA that commissioning activities are being scheduled into the master schedule.
2. Review and approve the final Commissioning Plan.
3. Attend a commissioning scoping meeting and other commissioning team meetings.
4. Perform the normal review of contractor submittals.
5. Furnish a copy of all construction documents, addenda, change orders, and approved submittals and shop drawings related to commissioning equipment to the CxA.
6. Review and approve the performance test procedures submitted by the CxA prior to testing.
7. Observe and witness as necessary startup and performance testing of selected equipment.
8. Review commissioning progress and deficiency reports.
9. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
10. Sign off (final approval) on individual commissioning tests as completed and passing.
11. Assist the CM / GC in coordinating the training of owner personnel.
12. Provide the BOD documents, as prepared by the design team and approved by the owner, to the CxA for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.
13. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
14. Assist the CxA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

F. Temperature Controls Contractor

1. Satisfy requirements of paragraph G (Contractors) below.
2. Participate in a control review meeting with the CxA and design professional. Review control designs for compliance with the contract documents, controllability with respect to actual equipment to be installed, and recommend adjustments to control designs and sequence of operation descriptions.

G. Contractors. [Each] Contractor and their subcontractors and vendors shall assign representatives with expertise and authority to act on their behalf. This person shall be responsible for communications between the subcontractor and the CM / GC commissioning coordinator. The responsibilities shall include but not be limited to the following:

1. Communicate with the CM / GC commissioning coordinator.
2. Attend commissioning meetings.
3. Facilitate the coordination of the commissioning activities and incorporate commissioning activities (the Commissioning Plan) into the Overall Project Schedule (OPS).
4. Provide copies of contractor tests.
5. Complete pre-functional construction checklists.
6. Review functional test procedures developed by the CxA.
7. Participate and assist during functional testing by the CxA.
8. Complete corrective action work.
9. Assemble O&M manuals, including clarifying and updating the original sequences of operation to as-built/as-tested conditions.
10. Provide specified training.
11. Assist the CxA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.
12. Include the cost of commissioning in the total contract price.
13. Ensure that all subcontractors and vendors execute their commissioning responsibilities according to the contract documents and the OPS.
14. Provide copies of all submittals as required, including all changes thereto.
15. Cooperate with the CxA for resolution of issues recorded in the Issue Log.

H. TAB Contractor. Review the contract documents with the CxA before developing TAB procedures and document the following in a report to the CxA:

1. Accessibility of equipment and components required for TAB work.
2. Adequate number and placement of duct balancing dampers to allow proper balancing while minimizing sound levels in occupied spaces.
3. Adequate number and placement of balancing valves to allow proper balancing and recording of water flow.
4. Adequate number and placement of test ports and test instrumentation to allow reading and compilation of system and equipment performance data needed to conduct both TAB and commissioning testing.
5. Air and water flow rates have been specified and compared to central equipment output capacities.
6. Discontinuities and omissions in the contract documents have been identified.

1.7 EQUIPMENT/SYSTEMS TO BE COMMISSIONED

A. The following equipment/systems will be commissioned in this project:

1. HVAC Systems.
   a. Energy Recovery Units
   b. Makeup Air Units
   c. Exhaust Fans
   d. VRF Indoor Units
   e. VRF Condensing Units
   f. Pumps
   g. Radiant Tube Heaters
   h. Unit Heaters
   i. Cabinet Unit Heaters

2. Plumbing
   a. Domestic Hot Water Systems, Pumps and Controls

3. Electrical
   a. Service and Distribution
   b. Lighting and Lighting Controls
   c. Daylighting Controls

4. Renewable Energy
   a. Photovoltaic Systems

5. Building Pressure Control – Verification that all of the HVAC systems work together as a whole to provide the correct building pressure as designed.
6. Verification of BAS Control System Features (Graphics, Trending, Alarming, Operations, etc.).

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Special equipment, tools, and instruments required for testing equipment according to these contract documents shall be included in the contractor’s base bid price and shall be turned over to the owner at project close-out.

B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances specified in the specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration to NIST traceable standards within the past year to an accuracy of 0.5 degree F and a resolution of + or - 0.1 degree F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer’s recommended intervals and whenever dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 MEETINGS

A. Scoping Meeting: The CxA will schedule, plan, and conduct a Cx scoping meeting with the owner to determine and finalize the desired scope of work.

B. Commissioning Kickoff Meeting: The General Contractor will schedule a commissioning kickoff meeting after contractor selection but prior to the commencement of construction of the commissioned systems, at a time convenient to the Owner, CxA, Contractor and subcontractors.

1. Attendees: Owner, General Contractor, subcontractors, CxA and other relevant parties shall attend the conference.

2. The meeting will be held at the project site or another convenient location.

3. The CxA will review commissioning responsibilities and personnel assignments.

4. General Contractor will record and distribute meeting minutes.

5. Agenda: Topics to be discussed during the meeting shall include, but not be limited to, the following:

   a. Commissioning Coordinator / Responsibilities
   b. Commissioning Plan and related specifications
   c. Pre-functional construction checklists
   d. Construction schedule and sequencing
   e. Submittal and shop drawing review procedures
   f. Construction and testing of mock-ups.
   g. Inspection and testing protocols, procedures, and test methods.
   h. Preparation of Record Documents
   i. Owner’s occupancy requirements
C. Miscellaneous Meetings: Other meetings will be planned and conducted by the CxA as construction progresses. These meetings will cover coordination, deficiency resolution, and planning issues with particular contractors and their subcontractors. The CxA will plan these meetings and will minimize unnecessary time being spent by contractors and subcontractors. These meetings will be held as required.

3.2 SUBMITTALS

A. The CxA will identify submittals to be delivered to the CxA. The CxA will review and provide comments to the design professional on submittals related to the commissioned equipment for conformance to the contract documents as it relates to the commissioning process, performance of the equipment, and adequacy for developing test procedures.

B. Submit copies of the above selected submittals and shop drawings to the CxA, concurrent with submittals to the design professionals.

C. The Design Professional maintains the ultimate responsibility of providing formal submittal approval or denial.

3.3 CONSTRUCTION PHASE DOCUMENTATION

A. Submit copies of Requests for Information (RFI), Architects Supplemental Instructions (ASI), and Change Orders (CO) to the CxA.

3.4 TEST AND BALANCE REPORT

A. Submit the completed test and balance report to the appropriate design professionals, as specified, and concurrently to the CxA, within one week of completion of work and prior to commencement of functional performance testing.

3.5 STARTUP, PRE-FUNCTION CONSTRUCTION CHECKLISTS, AND INITIAL CHECKOUT

A. The following procedures apply to all equipment/systems to be commissioned, according to Section 1.7 Equipment/Systems to be commissioned.

B. Startup and Checkout. Pre-functional construction checklists are important to verify that the equipment and systems are fully connected and operational. It ensures that performance testing (in-depth system checkout) may proceed without unnecessary delays. The pre-functional construction checklists will be generated by the CxA for a given system and must be completed and approved prior to formal functional performance testing of equipment or subsystems of the given system.

C. Sensor and Actuator Calibration. All field-installed temperature, relative humidity, CO, NO2, CO2, refrigerant, O2, and/or pressure sensors and gauges, and all actuators (dampers and valves) on all equipment shall be calibrated. Verify that all locations are appropriate and away from causes of erratic operation. Submit to the CxA through the CM / GC Coordinator the calibration methods and results. All test instruments shall have a certified calibration within the last 12 months to NIST traceable standards and comply with all local, state and/or federal requirements/certifications, as required. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated. The CxA reserves the right to observe on site calibration procedures.

D. Execution of Pre-functional Construction Checklists and Startup. Four weeks prior to the scheduled startup, the contractor shall coordinate startup and checkout with the CM / GC Coordinator. The execution and approval of the pre-functional checklists, startup, and checkout shall be directed and performed by the contractor, subcontractor or vendor. Signatures are
required of the applicable subcontractors for verification of completion of their work. The CxA reserves the right to observe startup procedures. Only individuals of the contractor (technicians, engineers, tradesmen, vendors, etc.) who have direct knowledge and witnessed that a line item task on the construction checklist was actually performed shall check off that item. It is not acceptable for witnessing supervisors to fill out these forms.

E. Contact SystemWorks for sample forms of Pre-functional Construction Checklists and Functional Performance Test as needed.

3.6 FUNCTIONAL PERFORMANCE TESTING

A. Requirements. The functional performance testing shall demonstrate that each system is operating according to the documented design intent and contract documents. Performance testing facilitates bringing the systems from a state of individual substantial completion to full dynamic operation. During the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

B. Coordination and Scheduling. The contractor shall provide sufficient notice regarding their completion schedule for the pre-functional checklists and startup of all equipment and systems to allow the performance testing to be scheduled. The CxA in association with the contractor/subcontractors and facility staff shall execute the tests. Performance testing shall be conducted after the pre-functional checklists and startup have been satisfactorily completed. The control system shall be sufficiently tested and approved by the CxA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before performance testing of air or water-related equipment or systems. Testing proceeds from components to sub-systems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems shall be checked.

C. Development of Test Procedures. Before test procedures are finalized, the contractor shall provide to the A/E and the CxA all requested documentation and a current list of changes affecting equipment or systems, including an updated points list, program code, control sequences, and testing parameters. Using the testing parameters and requirements in the technical specifications, the CxA shall update/develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Owner/PM and A/E shall review, comment and sign off on the functional test procedures developed by the CxA. Review for safety and operating issues. Submit, if appropriate, alternate approaches to achieving the same results. If changes to points list, program code, control sequences or system design occur after sign off of the completed test procedures provided by the CxA, the time required by the CxA to update/develop test procedures and forms will be charged to the CM / GC, who may choose to recover costs from the responsible subcontractor.

D. Test Methods. Performance testing and verification may be achieved by manual testing or by monitoring the performance and analyzing the results using the control system’s trend log capabilities or by stand-alone data loggers. The CxA will determine which method is most appropriate for tests that do not have a specified method. Contractors assisting in functional testing shall provide all personnel and equipment necessary for conducting the tests.

E. Problem Solving. The burden of responsibility to solve, correct and retest malfunctions/failures is with the CM / GC, contractor and design professionals.

F. Contact SystemWorks for sample forms of Pre-functional Construction Checklists and Functional Performance Test as needed.
3.7 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

A. Documentation. The CxA shall complete all documentation for performance testing.

B. Non-conformance

1. Corrections of minor deficiencies identified by the CxA may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the test form and on the Issue Log.

2. As testing progresses and deficiencies are identified, the CxA shall discuss such deficiencies with the commissioning team and responsible contractors. The following documentation will occur:
   a. When there is no dispute on the deficiency and the contractor accepts responsibility to correct the deficiency, the CxA will document the deficiency on the Issue Log. The Issue Log will be provided to the CM / GC. After the contractor corrects the deficiency, the contractor will update the Issue Log with the item status certifying the equipment is ready to be retested. The contractor shall reschedule the test and the test is repeated by the CxA.
   b. If there is a dispute about a deficiency, specifically whether or not it is a deficiency, the dispute shall be documented on the Issue Log with the contractor’s response. Resolutions will be made at the lowest management level possible. Other parties will be brought into the resolution discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the owner/PM. The CxA will document the resolution process. Once the resolution has been accepted, the contractor corrects the deficiency, completes the Issue Log with the item status certifying the equipment is ready to be retested. The contractor shall reschedule the test and the test is repeated by the CxA until satisfactory performance is achieved.

3. Cost of Retesting
   a. The cost for the contractor to retest a deficiency with the CxA, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the CM / GC.
   b. The time for the CxA to direct or retest because a specific item or sequence of operation reported to have been successfully completed, but determined during functional testing to be faulty or incomplete, will be back charged at $130.00/hr plus reimbursable expenses to the CM / GC, who may choose to recover costs from the party responsible.

4. The contractor shall submit in writing to the CM / GC Coordinator, at least as often as commissioning meetings are being scheduled, the status of each outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreement and proposals for their resolutions. The CxA retains the original Issue Log forms until the end of the project. Retesting shall not be considered a justified reason for a claim of delay or for a time extension by the contractor.

C. Failure Due to Manufacturer Defect. If 10% (or three, whichever is greater) of identical pieces of equipment fail to perform to the contract documents (mechanically or substantively) due to a manufacturing defect, thereby not allowing it to meet its submitted performance specification, all identical units may be considered unacceptable by the A/E or CxA. In such case, the contractor shall provide the owner or CM / GC with the following:

1. Within one week of notification from the owner/PM, the contractor or manufacturer’s representative shall examine all other identical units making a record of the findings. The findings shall be provided to the owner/PM within two weeks of the original notice.
2. Within two weeks of the original notification, the contractor or manufacturer shall provide a signed and dated written explanation of the problem, cause of failures, etc., and all proposed solutions. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
3. The A/E will determine whether a replacement of all identical units or a repair is acceptable.

4. Two examples, where applicable, of the proposed solution shall be installed by the contractor and the A/E shall be allowed to test the installations for up to one week, upon which the A/E will decide whether to accept the solution.

5. Upon acceptance, the contractor and/or manufacturer shall replace or repair all identical items at their expense. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

D. Approval. The CxA notes each satisfactorily demonstrated function on the test forms. Final approval of the functional performance tests is made by the Owner following recommendations by the CxA, PM, CM / GC and A/E.

3.8 DEFERRED TESTING

A. Unforeseen Deferred Tests. If any check or test cannot be completed due to the project completion level, required occupancy condition or other deficiency, execution of checklists and performance testing may be delayed upon approval of the CxA and PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

B. Seasonal Testing. During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system’s design) shall be completed as part of this contract. The CxA shall coordinate this activity through the owner/PM/CM/GC. Tests will be executed and documented by the CxA. Deficiencies shall be corrected by the appropriate contractor and witnessed by the CxA. Any final adjustments to the O&M manuals and as-builts due to the testing shall be made by the contractor.

3.9 TRAINING OF OWNER PERSONNEL

A. The contractor shall provide training coordination, scheduling of subcontractors, and ensure that training is completed. All training shall be coordinated through the CM / GC with review and approval by the CxA. The CxA reserves the right to attend or participate in training as necessary.

B. The contractor shall ensure that each subcontractor and vendor (mechanical, sheet metal, plumbing, fire, electrical, controls, specialty, etc.) will:

1. Provide through the CM / GC to the CxA a training plan 60 days before the planned training covering the following elements:
   a. Equipment
   b. Intended audience
   c. Location of training
   d. Objectives
   e. Subjects covered (description, duration of discussion, special methods, etc.)
   f. Duration of training on each subject
   g. Instructor for each subject
   h. Methods (classroom lecture, manufacturer’s quality video, site walk-through, actual operational demonstrations, written handouts, etc.)

2. Utilize and complete the “Operation and Maintenance Training Log” form provided by the CxA to submit and document completion of training.

C. At the discretion of the CxA, training may occur before performance testing is complete if required by the facility operators to assist the CxA in the performance testing.

D. Videotaping of the training sessions may be provided by the Owner, CM / GC or PM and added to the O&M manuals. If this is desired by the project owner, the CM / GC should allow time to
provide support for the video through both preparation and participation. In addition, factory training videos identifying key troubleshooting, repair, service and/or replacement techniques shall be provided and reviewed with the owner.

3.10 OPERATIONS AND MAINTENANCE MANUALS/DATA

A. The commissioning process requires detailed O&M documentation as identified in this section and technical specifications.

B. Contractor shall submit the complete operating and maintenance manuals including as-built shop drawings and plans prior to substantial completion. The CxA shall review the O&M manuals and documentation for systems that were commissioned to verify compliance with the as-built condition and specifications. The CxA will communicate through the CM / GC any deficiencies in the manuals to the contractor or A/E, as requested. Upon a successful review of any corrections, the CxA will recommend approval and acceptance of these sections of the O&M manuals. The CxA will also review each equipment warranty and verify that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E’s review of the O&M manuals according to the A/E’s contract.

C. Contractors will also be responsible for assisting in the creation of the LEED System Manual. Below is a matrix outlining the System Manual sections, responsible party and timeline for completion:

<table>
<thead>
<tr>
<th>Section</th>
<th>Responsible Party</th>
<th>Timeline for Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Summary</td>
<td>CxA</td>
<td>After Cx is Complete</td>
</tr>
<tr>
<td>Owner’s Project Requirements</td>
<td>CxA, Design Team, Owner</td>
<td>Pre-Design Phase</td>
</tr>
<tr>
<td>Basis of Design</td>
<td>MEP Engineers</td>
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</tr>
<tr>
<td>System Single Line Diagrams</td>
<td>MEP Contractors</td>
<td>After Cx is Complete</td>
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<tr>
<td>Construction Record Documents</td>
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<td>Approved Submittals</td>
<td>MEP Contractors</td>
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</tr>
<tr>
<td>As-Built Drawings</td>
<td>MEP Contractors</td>
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<tr>
<td>As-Built Sequence of Operation</td>
<td>Controls Contractor</td>
<td>After Cx is Complete</td>
</tr>
<tr>
<td>Original Setpoints for All Systems</td>
<td>CxA</td>
<td>After Cx is Complete</td>
</tr>
<tr>
<td>Commissioned</td>
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<tr>
<td>Recommended Schedule for Recommissioning</td>
<td>CxA</td>
<td>After Cx is Complete</td>
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<tr>
<td>Equipment Operations and Maintenance Manuals</td>
<td>CxA</td>
<td>After Cx is Complete</td>
</tr>
<tr>
<td>Equipment Preventative Maintenance Schedules</td>
<td>CxA</td>
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<tr>
<td>Confirmation of Completed Owner Training</td>
<td>CxA</td>
<td>After Cx is Complete</td>
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<tr>
<td>Ongoing System Optimization Procedures</td>
<td>CxA</td>
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</tr>
<tr>
<td>Final Commissioning Report</td>
<td>CxA</td>
<td>After Cx is Complete</td>
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</tbody>
</table>

END OF SECTION
SECTION 01 91 17
BUILDING ENCLOSURE FUNCTIONAL PERFORMANCE TESTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 0 and 1 Specification Sections, apply to this Section. Division 3, 4, 5, 7 and 8 Specification Sections also apply to this section. Where conflicts arise regarding building enclosure testing, this Section shall supersede other Sections where contradictions occur.

B. Refer to Section 01 91 13 for the general Building Systems Commissioning requirements.

C. Refer to 01 91 19 for the general Building Enclosure Commissioning requirements.

1.2 TESTING AGENCY

A. The Building Enclosure Testing Agency (BETA) shall be an independent third-party with a minimum five (5) years of experience performing the testing as outlined in this specification section.

B. The testing agency is to be contracted by the BECxP and all costs to complete and document the testing defined below shall be paid by the Owner. The testing agency shall be responsible for the specified testing outlined herein.

C. The General Contractor is responsible for any costs associated with retesting and additional testing, including costs related to observation and documentation of retesting and additional testing by the BECxP.

1.3 FIELD TEST REQUIREMENTS

A. New Facility – Field functional performance testing should focus on interfaces and transitions of building enclosure systems, materials, and assemblies. All testing will be performed prior to the installation of interior insulation, gypsum wall board, interior (supplemental) sealant joints, and finishes. The following functional performance shall be performed during the construction phase:

1. Air Barrier Adhesion Testing; ASTM D 4541 / ASTM D7234: Measured air barrier adhesion strength shall not be less than 10 lbf/sq. in. Testing performed at a minimum of two (2) areas randomly selected by the BECxP.

2. ASTM C 1521, Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints. Testing performed at three (3) areas randomly selected by the BECxP.

3. Water Leakage Test; AAMA 501.2: Testing shall be performed at all storefront, sloped glazing, and curtain wall systems. Testing shall include assembly interfaces and transitions with adjacent construction.

4. Static Quantitative Air Infiltration/Exfiltration; ASTM E779: Air infiltration/exfiltration during test shall not exceed limits specified. Testing area shall include all areas south of Apparatus Bay.

B. All field functional performance testing shall be conducted to project performance requirements as set forth in the Construction Documents and below:
Performance Test | Test Specimen | Performance Criteria
--- | --- | ---
Air barrier adhesion | Air barrier | > 10 lbf/sq. in
Sealant adhesion | Sealant joint | Cohesive failure
Water leakage | Fenestration | No water leakage

D. The water leakage requirements are as follows:
1. Water is contained and drained to the exterior
2. There is no wetting of a surface that is visible to the building occupants
3. There is no wetting or staining or other damage to completed building equipment, materials, or finishes

1.5 TESTING FAILURES

A. All failed testing areas are to be repaired and retested at the contractor's expense. Retesting shall be conducted by the BETA. All costs associated with the repair and retesting including all access, equipment, labor, and materials, as well as costs incurred by the BETA and BECxP site visits shall be the responsibility of the contractor.

B. Cost of Re-testing:
1. The cost to re-test a mock-up test or functional test, if they are responsible for the deficiency, shall be the subcontractor. If they are not responsible, any cost recovery for re-testing shall be paid by the General Contractor.
2. Any required re-testing by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the general contractor.
3. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of materials or assemblies fail to perform to the Contract Documents (physically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance specification, all identical units may be considered unacceptable by the General Contractor, subcontractor, sub-subcontractor, BECxP, A/E, or Owner. In such case, the General Contractor shall provide the Owner with the following:
   a. Within one (1) week of notification from the GC, Subcontractor, sub-subcontractor, BECxP, A/E or Owner that identifies a potential manufacturing defect, the particular contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the BECx team within one (1) week of the original notice.
   b. Within one (1) week of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full materials or assemblies submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
   c. The A/E and the Owner will determine whether a replacement of all identical units or a repair is acceptable.
   d. Two (2) examples of the proposed solution will be installed by the contractor and the BECxP will be allowed to test the installations, upon which the A/E and the Owner will decide whether to accept the solution.
   e. Upon acceptance, the contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original materials or assemblies warranty had begun.
The replacement/repair work shall proceed with reasonable speed beginning within one (1) week from when parts can be obtained.

C. In addition to re-testing, at the Owner’s discretion, failed tests may result in testing of at least one additional specimen at a location selected by the BECxP at the cost of the contractor. Testing will be concluded only when satisfactory results are achieved. All failed test specimens shall be repaired and retested until passing results are achieved.

D. Every effort will be made to expedite testing and minimize unnecessary delays, while not compromising integrity of tests. BECxP shall not overlook deficient work or loosen acceptance criteria to satisfy scheduling or cost issues unless directed to do so directly by the Owner.

E. Where testing indicates that performance requirements are not met, the contractor shall provide a repair plan for review by the BECT. Once the plan of repairs is agreed upon, Subcontractor corrects deficiency and provides written response and/or documentation on the MOL that the deficiency has been addressed and verifies that material or assembly is ready to be retested. GC informs BECT of retesting schedule and reschedules retesting with BECxP and BETA. Testing and resolution process is repeated until satisfactory performance is achieved. GC shall maintain free and clear access to the test area until satisfactory performance is achieved.

PART 2 PRODUCTS
Not Used

PART 3 EXECUTION
Not Used

END OF SECTION
SECTION 01 91 19
BUILDING ENCLOSURE COMMISSIONING

PART 1 GENERAL

1.1 GENERAL PROVISIONS
A. Attention is directed to Sections within Divisions 00 and 01 which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY
A. The intent of this Section is to provide for Building Enclosure Commissioning (BECx), and an agency qualified in the review, observation, functional testing, and analysis of the installation of various components of the building enclosure to be commissioned as per the Contract Documents.
1. Specified inspections, tests, and related actions do not limit contractor’s quality control procedures that facilitate compliance with Contract Document requirements.

1.3 COMMISSIONING
A. The systematic process of assuring by verification and documentation, from the design phase through construction, which building enclosure systems perform and interface in accordance with the design documentation and intent, and in accordance with the Owner’s Project Requirements.
B. The commissioning process does not take away from, or reduce the responsibility of, the General Contractor and installing subcontractors to provide a finished air and weather tight building enclosure.
C. The Building Enclosure Commissioning Provider (BECxP) is employed by the Owner, and shall not be an agent of, or a representative of a material supplier used for the project.
D. Testing required for BECx must be performed by the BECxP or Building Enclosure Testing Agency (BETA) hired by the BECxP. Testing required for BECx shall not be directly performed by the General Contractor or their agents. See below for commissioned systems and section 01 91 17 Building Enclosure Functional Performance Testing for related information.
1. Contractor is responsible for all tests not specifically outlined in Section 01 91 17 Building Envelope Functional Performance Testing.
E. This section shall in no way diminish the responsibility of Division 03, 04, 05, 07, 08, and 09 Contractors, Subcontractors, and Suppliers in performing all aspects of work and testing as outlined in the Contract Documents. Any requirements outlined in this section are in addition to requirements outlined in Division 03, 04, 05, 07, 08, and 09.

1.4 ABBREVIATIONS
A. The following are common abbreviations used in this Section (definitions are found further in this Section):
1. DP – Design Professional
2. BECx – Building Enclosure Commissioning
3. BECxP – Building Enclosure Commissioning Provider
4. BECxC – Building Enclosure Commissioning Coordinator
5. BECT – Building Enclosure Commissioning Team
6. BETA – Building Enclosure Testing Agency
7. BECx Record – Building Enclosure Commissioning
8. FPT – Functional Performance Test
9. GC – General Contractor
10. CT – Commissioning Team
11. CxA - Commissioning Authority - Refer to Section 01 91 13
12. O&M - Operations & Maintenance

1.5 DEFINITIONS

A. Approval: Acceptance that a material or system has been properly installed and is functioning in tested modes according to the Contract Documents.

B. Design Professional (DP): Architect and its sub-consultants who comprise the design team, generally the Architect of Record and any Design Sub-consultants.

C. Basis of Design (BOD): Documentation of primary thought processes and assumptions behind design decisions made to meet design intent. Describes systems, components, conditions, and methods chosen to meet intent.

D. Building Enclosure Commissioning Provider (BECxP): Contracted to Owner. BECxP directs and coordinates day-to-day Building Enclosure Commissioning activities.

E. Building Enclosure Commissioning (BECx) Kick-Off Meeting: The BECxP will conduct a BECx pre-construction kick-off meeting. The meeting is to be attended by the Building Enclosure Commissioning Team and any parties relevant to the design and construction of the building enclosure system. The BECx topics to be covered during the meeting include, but are not limited to, the BECx process, scheduling milestones, functional performance testing, and communication protocol.

F. Building Enclosure Commissioning Record (BECx Record): Overall BECx Summary Record provided at the conclusion of the construction phase of the project to provide summary documentation of the project Building Enclosure commissioning process.

G. Building Enclosure Testing Agency (BETA): Contracted to BECxP, BETA is responsible for executing building enclosure functional performance testing under the direction of the BECxP.

H. Building Enclosure Functional Performance Test (FPT): Test of performance of building enclosure materials and systems. Systems are tested under various simulated environmental conditions, such as air or water leakage under pressure differential. Refer to Section 01 91 17.

I. Commissioning Observation: Any condition identified by the BECxP that adversely affects the commissionability, operability, maintainability or functionality of a system, equipment or component. Any condition that is in conflict with the project OPR, Contract Documents, performance requirements, manufacturer
requirements, and/or standard industry best practices of the installed systems and components. (See also – Deficiency, Master Observation Log)

J. Contract Documents (CD): Refer to Sections 00 and 01.

K. Deficiency: See “Commissioning Observation”.

L. Master Observation Log (MOL): On-going list tracking commissioning observations and BECT responses and resolution.

M. Mock-up: Freestanding, on-site, off-building structure which includes representative portions of building enclosure systems, assemblies, and components. The mock-up shall be constructed, tested, and reviewed prior to commencement of building enclosure construction.

N. Owner’s Project Requirements (OPR): A written document that details the project requirements and the expectations of how the building and its systems will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

O. Pre-Installation Meeting: The GC will conduct a pre-installation meeting with the appropriate subcontractors for each building enclosure system to be installed. All Building Enclosure Commissioning Team members are welcome to participate.


Q. Sub-contractor: Contractors of GC, and their Sub-contractors, who provide and install building enclosure components and systems.

1.6 COORDINATION

A. Building Enclosure Commissioning Team: Members of the Building Enclosure Commissioning Team (BECT) will consist of:
   1. Design Professional (DP)
   2. Building Enclosure Commissioning Provider (BECxP)
   3. Building Enclosure Testing Agent (BETA)
   4. Building Enclosure Commissioning Coordinator (BECxC)
   5. Building Enclosure Subcontractors/Vendors
   6. General Contractor (GC)
   7. Owner’s Representative(s)

B. Management: All members of the Commissioning Team shall cooperate to fulfill contracted responsibilities and objectives of the Contract Documents.

C. Scheduling: BECxP will work with the BECT to establish required commissioning activities to incorporate in preliminary commissioning schedule. The GC will integrate commissioning activities into a master construction schedule. Necessary notifications are to be made in a timely manner in order to expedite the commissioning process.
1.7 SUBMITTALS

A. Submittals will be obtained through a project file sharing site. Reference Submittal Procedures Section 01 33 00.

B. The BECxP shall review building enclosure related submittals and shop drawings prior to the DP for conformance as it relates to BECx such that the BECxP comments can be incorporated into the returned submittal.

C. The contractor(s) shall review and address all exterior enclosure related submittal and shop drawing review comments. Revised shop drawing details based on submittal review comments shall be clearly marked on the shop drawing resubmittal to indicate where and what changes have been made. BECxP submittal and shop drawing review comments and responses shall be tracked in the MOL.

D. The BECxP review of submittals and shop drawings does not substitute for or alter the responsibility of the DP to review submittals and/or shop drawings for compliance with the project requirements. Final approval of submittals and shop drawings rests solely with the DP.

PART 2 PRODUCTS
Not Used

PART 3 EXECUTION

3.1 SYSTEMS TO BE COMMISSIONED

A. Building Enclosure Systems to be commissioned:

B. Specific Sections containing components or assemblies to be commissioned:
   1. 042000 – Unit Masonry
   2. 042213 – Reinforced Unit Masonry
   3. 072100 – Thermal Insulation
   4. 072700 – Underslab Vapor Barrier
   5. 072713 – Self-Adhering Sheet Air and Moisture Barrier
   6. 075400 – Thermoplastic Membrane Roofing – Fully Adhered
   7. 079200 – Joint Sealants
   8. 081113 – Hollow Metal Doors & Frames (Exterior)
   9. 083300 – Insulated Rolling Service Doors
   10. 083513 – Four-Fold Exterior Doors
   11. 084112 – Aluminum Framed Entrances
   12. 084413 – Glazed Aluminum Curtain Walls
   13. 084513 – Structured Polycarbonate Panel Assemblies
   14. 088000 - Glazing

3.2 RESPONSIBILITIES OF COMMISSIONING TEAM MEMBERS

A. Design Professional (DP)
   1. Attend BECx design review meetings.
   2. Attend BECx Kick-Off meeting and other commissioning team meetings.
3. Attend enclosure pre-installation meetings.
4. Review and respond to/incorporate BECxP comments made during design reviews and submittal/shop drawings reviews.
5. Assist in dispute resolution regarding building enclosure systems.
6. Review BECxP reports and respond to items.

B. Building Enclosure Commissioning Provider (BECxP)
1. Review pertinent building enclosure related submittals and shop drawings.
2. Conduct BECx Kick-Off meeting. Minutes to be issued by BECxP.
3. Participate in on-site pre-installation meetings.
4. Provide a minimum of 4 construction observation and testing visits to observe, test, and document the installation of the commissioned building enclosure components and assemblies.
5. Make recommendations to assist in solving discrepancies.
6. Create Construction Checklists for use in installation verification and testing documentation for the following components and assemblies:
   a. 072713 – Self-Adhering Sheet Air and Moisture Barrier
   b. 075400 – Thermoplastic Membrane Roofing – Fully Adhered
   d. 079200 – Joint Sealants
   e. 084413 – Glazed Aluminum Curtain Walls
   f. 084513 – Structured Polycarbonate Panel Assemblies
8. Create Functional Test Procedures for use in identifying installation and testing compliance for the following components and assemblies:
   a. 072713 – Self-Adhering Sheet Air and Moisture Barrier
   b. 079200 – Joint Sealants
   c. 084413 – Glazed Aluminum Curtain Walls
   d. 084513 – Structured Polycarbonate Panel Assemblies

C. Building Enclosure Commissioning Coordinator (BECxC)
1. The purpose of this Contractor’s coordinator shall be to prevent conflicts in the installation of all materials and equipment for the entire project, but not specifically relating to the Building Enclosure trades.
2. The General Contractor shall designate a Building Enclosure Commissioning Coordinator (BECxC) who shall specifically ensure, and be responsible for, the total and complete coordination of all work of the Building Enclosure subcontractors as such work relates to the General Contractor’s work and all other subcontractors.
3. The BECxC shall be the primary contact for the BECxP, and shall assist the BECxP communicate necessary information to the subcontractors.
4. The BECxC shall be named prior to the BECx Kick-Off Meeting.
5. BECxC shall ensure accurate and timely completion of the BECx Construction and Inspection Checklists, and be responsible for transmission to the BECxP for review.
6. The BECxC shall be provided until all building enclosure systems have been commissioned and accepted by both the Design Professional and the Owner.

D. General Contractor (GC)
1. Attend BECx Kick-Off meeting and other commissioning team meetings. The GC is responsible for all coordination items with Subcontractors.
2. Conduct enclosure pre-installation meetings. The GC is responsible for all coordination items with Subcontractors.
   a. Review of Installer Qualifications and/or Certifications
b. Review of complete approved submittals
c. Review of project specific shop drawing and architectural details
d. Review of the mockup schedule, installation, inspection, and testing
e. Review of the BECx Construction and Inspection Checklists
f. Review of component installation limitations, i.e. weather, compatibility, sequence
g. Review of Inspection and Testing procedures, including Contractor and Manufacturer Representative reviews and documentation
h. Review of In-Situ Installation Schedule
i. Participants shall include the Owner Representative, DP, BECxP, Testing Agency, Contractor, Installer’s Project Manager and Lead Installer, and Assembly Manufacturer Technical Representative.

3. Incorporate and periodically update commissioning activities into the construction schedule.
4. The GC is responsible for retesting and additional testing due to failure as defined in the Building Enclosure Functional Performance Testing specification 01 91 17.
5. Facilitate cooperation of Subcontractors in commissioning work.
6. Review and respond to BECxP’s submittal review comments.
7. Verify building enclosure materials and assemblies are ready for functional performance testing. Coordinate scheduling of Building Enclosure FPT with the BECxP and BETA at least two weeks prior to testing.
8. Ensure resolution of non-compliance and deficiencies in construction or test results. Provide written responses and documentation of completion from the appropriate subcontractors and record responses on the MOL.
9. Provide letters of compatibility for adjacent building enclosure materials and assemblies.
10. Facilitate all repairs and retesting of failed functional performance testing and pay for all associated costs of retesting and additional testing including costs related to testing observation and documentation by the BECxP.
11. Following failed mock-up or field testing, provide a plan of repairs to be performed to the BECT for review. DP shall approve plan of repairs prior to implementation and retesting. All repairs performed to facilitate successful testing must be approved by the DP and performed comprehensively throughout project.
12. Provide all warranty documentation for all commissioned building enclosure systems, materials, and components to the BECxP.
13. The GC shall designate a BExCx.

E. Subcontractors/Vendors
1. Review building enclosure related specification sections.
2. Provide project-specific submittals/shop drawings as required by the project specifications that clearly indicate how each system is interfaced with adjacent systems. All typical and project-specific interfaces with adjacent systems must be detailed accurately.
3. Attend BECx Kick-Off meeting and other commissioning team meetings.
4. Attend enclosure pre-installation meetings.
5. Address MOL observations.
6. Attend all required building enclosure functional performance testing.
7. Ensure installed work is complete, is in compliance with Contract Documents, and is ready for Functional Performance Testing. Notify GC that systems are ready for Functional Performance Testing.
8. Shall provide Lift Equipment and operator(s) necessary to access verification and/or inspection areas and/or facilitate testing.
9. Provide all warranty documentation for all commissioned building enclosure systems, materials, and components to the GC.

F. Building Enclosure Testing Agency (BETA)
   1. Attend BECx Kick-Off meeting and other commissioning team meetings.
   2. Provide technicians and equipment to complete field Building Enclosure Functional Performance Testing.
   3. Prepare and submit reports at the conclusion of each test.
   4. Perform retesting and/or additional testing due to failed tests and prepare corresponding reports.

3.3 BUILDING ENCLOSURE COMMISSIONING (BECx) TEAM MEETINGS
   A. BECxP will conduct a BECx Kick-Off meeting attended by all members of the BECx Team.
   B. BECx progress meetings will be held periodically as determined by the BECxP. Attendees shall include at a minimum, the Installing Component/Assembly Foreman, BECxC, BECxP, Owner Representative, and DP.
   C. Discussions held in BECx meetings shall include, but not be limited to, system/materials, mock-up/field progress, scheduling, testing, documentation, deficiencies, and problem resolution.

3.4 REPORTING
   A. The BECxP will provide periodic status reports to Owner, DP, GC, and CxA.
   B. The BECxP shall submit non-compliance and deficiency reports to the Owner, DP, GC, and CxA.
   C. BECxP shall provide a final BECx Record to Owner.

3.5 MOCK-UP AND FINAL CONSTRUCTION
   A. The GC and Subcontractors shall verify completion of assemblies compliant with project documents and deficiency log items prior to functional performance testing or concealment of functional performance layers within the building enclosure.

3.6 BUILDING ENCLOSURE FUNCTIONAL PERFORMANCE TESTING
   A. Refer to Section 019117 – Building Enclosure Functional Performance Testing

3.7 DOCUMENTATION, NON-CONFORMANCE, AND RESOLUTION
   A. Documentation
      1. The BECxP shall submit observation reports Owner, DP, GC, and CxA and log commissioning observations in the Master Observation Log (MOL).
B. Non-Conformance
1. Deficiency or non-conformance issues will be noted and reported to the GC, DP, and Owner.
2. Corrections of minor deficiencies identified during site observations and testing may be documented by the BECxP.
3. Deficiencies are handled in the following manner:
   a. When there is no dispute on deficiency and Subcontractor accepts responsibility for remedial action.
      i. BECxP documents deficiency and Subcontractor response and intentions. BECxP submits report and MOL to Owner, DP, GC, and CxA. Copy is provided to Subcontractor by GC.
      ii. Subcontractor corrects deficiency and provides written response and/or documentation on the MOL that the deficiency has been addressed.
   b. When there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
      i. BECxP documents deficiency and Contractor’s response. BECxP submits observation report and MOL to Owner, DP, GC, and CxA. Copy is provided to Subcontractor by GC.
      ii. GC facilitates resolution of deficiency. Other parties are brought into discussions as needed. Final interpretive authority is with DP. Final acceptance authority is with the Owner.
      iii. GC documents resolution process.
      iv. Once interpretation and resolution has been decided, appropriate party corrects deficiency and provides written response and/or documentation on the MOL that the deficiency has been addressed.

3.8 CLOSE OUT DOCUMENTATION

A. Final Report Details
1. The final BECx report will include an executive summary, overview of BECx activities, and general description of testing and verification results. Report will contain a log of design review comments and responses, a log of submittal review comments and responses, and the master observation log.
2. All outstanding non-compliance items will be specifically listed.
3. Recommendations for improvement to system or operations, future actions, etc. will also be listed.

B. Contractor shall provide the BECxP all requested documentation necessary to close out the BECx process, to include but not limited to:
1. Completed and signed Construction Checklists.
2. As-Built shop drawings of BECx systems.
3. Manufacturer representative inspection and testing reports.
4. Copies of warranties and material maintenance requirements.

END OF SECTION
SECTION 03 10 00
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Design, construction and treatment of formwork and related accessories to confine and shape concrete to the required dimensions.
B. Installation of embedded items such as waterstops.
C. Structural notes indicated on the drawings regarding concrete formwork shall be considered a part of this specification.

1.2 RELATED WORK
A. Pertinent Sections of Division 01.
B. Section 03 20 00 - Concrete Reinforcement.
C. Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCES
A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified. Where provisions of the pertinent codes and standards conflict with this specification, the more stringent provision shall govern.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.
5. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
7. NIST - PS 1: Structural Plywood
B. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, “FSC Principles and Criteria for Forest Stewardship.”

1.4 TESTING AND INSPECTION
A. Special Inspection and Testing:
1. In accordance with Chapter 17 of the International Building Code, the Owner shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704.0.
2. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.
3. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.

4. Duties of the Special Inspection Agency:
   a. Perform all testing and inspection required per the Testing and Inspection Schedule indicated below.
   b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.
   c. Submit a final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency’s knowledge in conformance with the approved plans and specifications.

5. Structural Component Testing and Inspection Schedule for Section 0310003 10 00 is as follows:

<table>
<thead>
<tr>
<th>Concrete and Concrete Placement</th>
<th>Continuous</th>
<th>Periodic</th>
<th>Referenced Standard</th>
<th>IBC Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect formwork for shape, location and dimensions of the concrete member being formed.</td>
<td>X</td>
<td></td>
<td>ACI 318:</td>
<td>26.11.1.2 (b)</td>
</tr>
</tbody>
</table>

1.5 DESIGN REQUIREMENTS

A. Design and engineering of formwork is the responsibility of the Contractor. Design, engineer and construct formwork, shoring, and bracing to conform to Contract Documents and in accordance with building code requirements. Design for construction loads, lateral pressure, and requirements of the applicable building code to conform to the required shape, line and dimensions.

B. Foundation concrete may be placed directly into neat excavations, provided the foundation trench walls are stable as determined by the Geotechnical Engineer. In such case, the minimum formwork indicated on the drawings is mandatory to ensure clean excavations immediately prior to and during the placing of concrete.

   1. When forms are omitted, provide additional 1” concrete minimum on each side of the minimum design profiles and dimensions shown on the drawings.

C. Drawings show the design requirements and dimensions for structural strength, but structural drawings do not show all detail dimensions to fit intricate architectural and mechanical detail. Contractor shall so construct the concrete work that it will conform to the clearance required by the architectural, mechanical and electrical design.

D. Maximum deflection of facing materials forming concrete surfaces exposed to view shall be 1/240 of the center-to-center span between structural members of the formwork.
E. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose. Where adequate foundations for shores and struts cannot be secured, provide trussed supports.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer’s product data, installation instructions and specifications for each of the following:

1. Waterstop profiles
2. Form sealer
3. Form release agent(s), including certification that agent is compatible with finish
4. Form ties and spreaders

B. Testing for Formwork Removal: When methods other than cylinder tests are proposed for determining time for formwork removal, submit data on methods for approval.

1.7 COORDINATION

A. Coordinate with other sections of work that require attachment of components to formwork.

B. If formwork is placed after reinforcement, resulting in insufficient concrete cover to reinforcement, request instructions from the Owner’s Representative or Architect or SEOR before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS AND ACCESSORIES

A. Formwork Accessories: Use commercially manufactured accessories for formwork accessories that are partially or completely embedded in concrete, including ties and hangers.

B. Sealer: Clear, penetrating, synthetic resin sealer.

C. Formwork Release Agent: Use commercially manufactured form release agents that will prevent formwork absorption of moisture, prevent bond with concrete, and will not stain the concrete surface. Reapply to cleaned forms before each reuse. Formwork release agent shall be compatible with paint or any other finish applied to the concrete; submit data indicating compatibility.

D. Waterstops: Waterstops shall be a flexible butyl rubber and bentonite clay compound that swells upon contact with water. Acceptable manufacturer’s and products:

1. CETCO – Waterstop RX
2. Greenstreak – Swellstop
3. J.P. Specialties – Earth Shield (Type 20 & 23) Waterstop

E. Form Material:

1. No aluminum shall be allowed in the concrete work unless coated to prevent aluminum-concrete reaction.

2. Concrete form materials must be used in a manner to provide the surface finish specified.
3. Design formwork in accordance with the provisions of the building code or the following standards if not covered in the building code:
   a. Wood - AF & PA “National Design Specification”.
   b. Plywood - American Plywood Association “Plywood Design Specification”.
   e. Concrete - ACI 318.
   f. Other materials - as directed by manufacturer.

F. Chamfer Strips:
   1. Chamfer strips shall be the size as indicated on the drawings. Provide in maximum possible lengths.

2.2 FORM FINISHES

A. Rough Form Finish:
   1. Concrete surfaces not exposed to view in the finished work shall have a rough-form finish. No form-facing material is specified for rough-form finish.
   2. Set and maintain forms so finished concrete dimensions shall conform to the tolerances. Rough form finish is Designated Surface Finish-1.0 from ACI 301, except that surface tolerance Class C is required as specified in ACI 117.

B. Smooth Form Finish:
   1. Concrete surfaces exposed to view in the finished work or surfaces to receive finishes of any type (paint, textured paint, etc.) shall have a smooth form finish. Form-facing material shall be plywood, tempered concrete-form-grade hardboard, metal, plastic, paper, or other acceptable material capable of producing the desired finish. Form-facing material shall produce a smooth, uniform texture on the concrete. Do not use form facing material with raised grain, torn surfaces, worn edges, patches, dents, or other defects that might impair the texture of the concrete surfaces.
   2. Set and maintain forms so finished concrete dimensions shall conform to the tolerances. Smooth form finish is Designated Surface Finish-3.0 from ACI 301, including surface tolerance Class A as specified in ACI 117.

C. Patching and repairing concrete finishes are specified under Section 03 30 00.

2.3 FABRICATION AND MANUFACTURE

A. Form Ties and Spreaders: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms, hold inner and outer forms for vertical concrete together, and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1-1/2 inch to the plane of the exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

4. At horizontal pour lines, locate ties not more than 6" below the pour lines. Tighten after concrete has set and before the next pour is made.

5. For exposed concrete surfaces, provide form ties of removable type with permanent plugs and a system approved by the Architect for fixing the plugs in place.

B. Waterstops: Fabricate pieces of premolded waterstop with a maximum practicable length to hold the number of end joints to a minimum. Fabricate joints in waterstops in accordance with manufacturer’s recommendations.

PART 3 - EXECUTION

3.1 CONSTRUCTION OF TEMPORARY FORMWORK

A. In accordance with ACI 301, construct formwork:

1. Design, erect, shore, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Fabricate forms for easy removal without hammering or prying against concrete surfaces.

1. Provide crush or wrecking plates where stripping may damage cast concrete surfaces.

C. Where end-of-work sequence requires a joint in the concrete, provide adequately designed additional formwork. Extend reinforcement through formwork as indicated on the drawings. Location of the construction joint is subject to approval by the Architect and the SEOR.

D. Forms for Exposed Concrete:

1. At construction joints, lap contact surface of the form sheathing for flush surfaces exposed to view over the hardened concrete in the previous placement by not more than 1 inch. Ensure formwork is held firmly against hardened concrete to prevent offsets or loss of mortar at construction joints and to maintain a true surface.

2. Provide watertight formwork when architectural exposed concrete is specified.

3. Unless specified in the Contract Documents, construct formwork so concrete surfaces conform to tolerance limits. The class of surface for offset between adjacent pieces of formwork facing material shall be Class C, unless specified otherwise.

4. Do not use metal cover plates for patching holes or defects in forms.

5. Provide sharp, clean corners at intersecting plans, without visible edges or offsets.

6. Fill all unwanted joint openings with specified joint filler and finish flush to match adjacent form surfaces.
E. Do not use rust-stained steel form-facing material.

F. Provide temporary openings at the base of column and wall formwork and at other points where necessary to facilitate cleaning and inspection.

G. Unless noted otherwise, all footings shall be centered under walls, piers or columns.

H. Provisions for Other Trades:
   1. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for support of adjoining work prior to concrete placement.
   2. Position and support expansion joint material and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.

I. Projecting corners of beams, walls and columns shall be formed with a 3/4-inch chamfer, unless noted otherwise on architectural drawings.

J. Cleaning:
   1. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign material before concrete is placed.
   2. Cover surfaces of formwork with acceptable formwork release agent. Apply form release agent before placing reinforcing steel and concrete according to manufacturer’s written instructions. Do not allow formwork release agent to puddle in forms. Do not allow formwork release agent to contact reinforcing steel or hardened concrete against which fresh concrete is to be placed. Do not apply form release agent to concrete surfaces receiving special finishes or applied coverings affected by the agent.
   3. Clean and inspect formwork immediately before concrete is placed.

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

L. Install void forms in accordance with manufacturer’s recommendations. Protect forms from moisture or crushing.

3.2 COORDINATION

A. Install all required pipe sleeves, cavities or slots. Notify appropriate trades in due time so that they may furnish information and make necessary installations. Check sizes, location and alignment of all openings, frames and other work, which are to be built-in including electrical boxes and conduit.

B. Layout the run of partitions and establish location of openings so that other trades may properly locate their work.

C. Core drilling concrete is not permitted unless noted otherwise or approved in writing by the Architect. Notify the Architect in advance of conditions not shown on the drawings.
3.3 INSTALLATION OF EMBEDDED ITEMS

A. Built-In Items:
   1. Confirm with Architect that all materials to be embedded are suitable for embedment in concrete.
   2. Build in anchors, inserts, and other devices indicated or required for various portions of work.
   3. Build in sleeves, thimbles, and other items furnished or set in place by other trades.
   4. Accurately position and support all embedded items prior to concrete placement. Secure embedded items against displacement during concrete placement operations.
   5. Fill voids with readily removable material to prevent entry of concrete into voids.
   6. Mechanical and electrical shall provide and set required sleeves.
   7. Coordinate setting of all embedded items.

B. Waterstops:
   1. Locate waterstops in joints where indicated on the drawings.
   2. Build in waterstops using longest unbroken lengths possible to hold the number of end splices to a minimum.
   3. Form splices and intersections strictly according to the manufacturer’s instructions so that waterstops are continuous and develop effective watertight joint.
   4. Locate waterstops as shown on the drawings. In general, waterstops should be located just behind outermost layer of reinforcing. Do not place waterstops closer than 2" from face of concrete.

3.4 TOLERANCES

A. Construction formwork to maintain tolerances required by ACI 301 and ACI 117.

3.5 REMOVAL OF FORMS

A. When removal of formwork is based on concrete reaching a specified compressive strength, concrete will be presumed to have reached this strength when either of the following requirements has been met:
   1. Test cylinders, molded and cured under the same conditions for moisture and temperature as used for the concrete they represent, have reached the specified compressive strength.
   2. Concrete has been cured in accordance with the specifications for the same length of time as laboratory-cured cylinders, which have reached the specified strength. Determine the length of time concrete has been cured in the structure by the cumulative number of days or fractions thereof, not necessarily consecutive, during which the temperature of the air in contact with the concrete is above 50°F and the
concrete has been damp or thoroughly sealed from evaporation and loss of moisture.

B. Forms shall remain in place for the following periods of time. These periods represent cumulative number days or hours, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above 50°F:

1. Walls, Grade Beams, Columns, Sides of Beams, Girders and Footings: 67% specified compressive strength or minimum 24 hours.

C. When finishing is required, remove forms as soon as removal operations will not damage concrete.

D. Loosen wood formwork for wall openings when this can be accomplished without causing damage to concrete.

E. Do not allow removal of formwork to damage the fresh concrete for columns, walls, sides of beams, and other parts supporting the weight of the concrete. Perform needed repair and treatment required on vertical surfaces at once and follow immediately with specified curing.

3.6 REMOVING AND REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect

END OF SECTION 03 10 00
PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Fabrication and placement of reinforcing steel for concrete, and all related accessories.
   B. Reinforcing steel for use in bond beams, masonry columns, and lintels is specified in Division 4 and is not a part of the work in this section.
   C. Structural notes indicated on the drawings regarding concrete reinforcement shall be considered a part of this specification.

1.2 RELATED WORK
   A. Pertinent Sections of Division 01.
   B. Section 03 10 00 - Concrete Formwork.
   C. Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCES
   A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified. Where provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.
      2. ACI 301 - Specifications for Structural Concrete.
      3. ACI 318 - Building Code Requirements for Structural Concrete.
      6. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
      7. ASTM A706 - Standard Specification for Deformed and Plain Low-Allow Steel Bars for Concrete Reinforcement.

1.4 TESTING AND INSPECTION
   A. Special Inspection and Testing:
      1. In accordance with Chapter 17 of the International Building Code, the Owner shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704.0.
      2. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.
3. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.

4. Duties of the Special Inspection Agency:
   a. Perform all testing and inspection required per the Testing and Inspection Schedule indicated below.
   b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.
   c. Submit a final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency’s knowledge in conformance with the approved plans and specifications.

5. Structural Component Testing and Inspection Schedule for Section 03 20 00 is as follows:

<table>
<thead>
<tr>
<th>Concrete and Concrete Placement</th>
<th>Continuous</th>
<th>Periodic</th>
<th>Referenced Standard</th>
<th>IBC Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection of fabricators and during fabrication.</td>
<td>X</td>
<td></td>
<td>1704.2</td>
<td></td>
</tr>
</tbody>
</table>

1.5 SUBMITTALS

A. Placing Drawings: Submit placing drawings showing fabrication dimensions and locations for placement of reinforcement and reinforcement accessories. Indicate bar sizes, spacing, locations, and quantities of reinforcing steel, bending and cutting diagrams, anchors, and supporting and spacing devices. Dowels shall be shown in placing drawings for the element that is to be placed first. Reinforcing steel descriptions or shop drawings shall be inch-pound sizes.

B. Manufacturer’s Certifications:
   1. Submit mill certifications at time of delivery.
   2. Submit carbon equivalent (CE) for reinforcing bars to be welded.

C. Splices: Submit request for splices not indicated in the Contract Documents. Request shall indicate locations, types, and lengths of splices for approval.

D. Field Bending: Submit requests and procedure for field bending or straightening of reinforcement partially embedded in concrete not described in the Contract Documents.

E. Reinforcement Relocation: Submit requests to adjust reinforcement spacing necessitated by conflicts with other reinforcement, conduits, etc. for approval.
F. LEED Certification: Submit manufacturer’s certification for reinforcement including the following:

1. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer’s name, product cost and location of extraction or harvest of raw materials.

1.6 COORDINATION

A. Coordinate reinforcement installation with the placement of formwork and other embedded items such as inserts, conduit, pipe sleeves, drains, metal supports, anchor rods, etc.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement to the jobsite in bundles sorted and labeled with durable tags indicating bar size, length, and shop drawing mark. Bundles shall also bear testing laboratory tags indicating identified steel.

B. Store elevated clear of ground and protect at all times from contamination and deterioration.

C. Prevent bending, coating with earth, oil, or other material, or otherwise damaging the reinforcement.

D. Store welding electrodes in accordance with the requirements of AWS D1.4.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bar Deformations: Bars used for reinforcement shall be deformed except column spirals and welded wire reinforcement, which may be plain.

B. Reinforcing Steel: Reinforcing steel shall conform to the ASTM standard and grade indicated in the General Notes on the drawings.

C. Welded Wire Reinforcement: Welded wire reinforcement shall conform to the ASTM standard indicated in the General Notes on the drawings.

D. Joint Dowel Bars: Plain-steel bars. Cut bars true to length with square ends and free of burrs.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

2. Concrete cast against earth: Bars may be supported by precast concrete bricks or approved prefabricated wire bar supports complying with CRSI recommendations with footpads large enough to support the weight of the bars and construction
2.2 FABRICATION

A. Fabrication Tolerances: Reinforcing steel shall be shop fabricated within tolerances according to ACI 117 and other applicable codes, and shall conform in size, shape, quantity, dimensions, etc. to the construction drawings and approved shop drawings.

B. Bar Condition: Bars shall be free from mill scale, excessive rust and other coatings, which would reduce or destroy the bond with the concrete. Wipe oil from forms before reinforcement is placed on or adjacent to so that oil will not be tracked over or in any way come into contact with the reinforcement.

C. Bars Bending: Bars shall be bent cold, and no method of fabrication shall be used which would be injurious to the material. Heating of bars for bending is not permitted.

D. Identification: After fabrication, bars shall be sorted, bundled and tagged with metal tags bearing the bar mark before delivery to the jobsite.

E. Corner Bars: Provide corner bars to make reinforcing continuous at all times, including intersections at footings, walls, beams or caps. Such bars shall be the same size and spacing as the horizontal reinforcing and each leg shall have a length of at least 30 inches.

F. Locate reinforcing splices not indicated on drawings at point of minimum stress. Review location of splices with the SEOR and obtain written approval prior to proceeding.

G. Where beams and grade beams are simple span, top bars shall be continuous for full length and hooked down at each end.

H. Reinforcing for continuous footings shall extend into spread footings a minimum of 2'-0".

I. Dowels between footings and walls or columns shall be the same grade, size and spacing or number as the vertical reinforcing respectively, unless noted otherwise.

2.3 LEED CREDIT

A. LEED Credit MRc 5.1/5.2:

1. Steel products shall be manufactured within 500 miles of project site. Recycled steel products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 PLACING

A. Reinforcement Relocation: When necessary to move reinforcement beyond the specified spacing to avoid interference with other reinforcement, or embedded items, submit resulting arrangement of reinforcement to SEOR for approval.

B. Reinforcement Cutting: Cutting of reinforcement which conflicts with embedded objects is not acceptable.

C. Welded Wire Reinforcement: Extend welded wire reinforcement to within 1 inch of the concrete edge. Lap edges and ends of fabric sheets a minimum of two full mesh squares.
Lace edges with 16-gauge tie wire. Support welded wire reinforcement during placing of concrete to assure required positioning in the slab. Do not place wire reinforcement on grade or metal deck and raise into position in freshly-placed concrete.

D. Wire Tie Orientation: Set wire ties so that ends are directed away from concrete surface.

E. Slab on Grade Reinforcement Placement: Place shrinkage and temperature reinforcement 2 inches from the top surface of the slabs on grade unless noted otherwise on the drawings.

F. Do not cut, displace, or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

G. Support for Reinforcement: Unless noted otherwise, supports for reinforcement shall have Class 2 protection as defined in the CRSI Manual of Standard Practice. Submit data on supports indicating class of protection at all different locations for approval. Supports shall not be used as bases for runways for concrete-conveying equipment and similar construction loads. Do not place reinforcing bars more than 2” beyond last leg of any continuous bar support.

H. Support for Bars in Concrete Cast on Ground: Bar supports for slabs on grade, grade beams, footings, and all other concrete cast directly onto grade shall be supported at an average spacing of 4 feet or less in each direction.

I. Securing Reinforcing Bars: All bars must be placed, spaced, secured and supported prior to casting concrete. Bars embedded in hardened or partially hardened concrete shall not be bent unless approved in writing prior to placement by the SEOR.

J. Foot Traffic: Restrict foot traffic over the slab on grade reinforcing after it has been properly positioned.

K. Reinforcement at Expansion Joints: Do not continue reinforcement or other embedded metal items bonded to concrete through expansion joints. Dowels bonded on only one side of a joint and waterstops may extend through joint.

L. Pumping Concrete: When using a pump to place concrete, pump hose shall be supported directly on forms. Do not allow hose to rest on reinforcing bars if doing so could cause displacement of bars.

END OF SECTION 03 20 00
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. All items required for executing and completing the cast-in-place concrete work and related work shown on the drawings or specified herein. Work shall include installation of items furnished in other sections of these specifications.

B. Concrete paving, walks, and curbs are specified in Division 3 or 32.

C. Structural notes indicated on the drawings regarding cast-in-place concrete shall be considered a part of this specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.
B. Section 03 10 00 - Concrete Formwork.
C. Section 03 20 00 - Concrete Reinforcement.
D. Section 03 38 10 - Unbonded Post-Tensioned Concrete.
E. Section 05 31 00 - Steel Deck.
F. Section 07 27 00 – Underslab Vapor Barrier

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified. Where any provision of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

2. ACI 301 - Specifications for Structural Concrete.
3. ACI 302.1R - Guide to Concrete Floor and Slab Construction.
4. ACI 302.2R - Guide for Concrete Slabs that Received Moisture-Sensitive Flooring Materials.
7. ACI 305.1 - Specification for Hot Weather Concreting.
9. ACI 308R - Guide to External Curing of Concrete.
10. ACI 309R - Guide for Consolidation of Concrete.
11. ACI 318 - Building Code Requirements for Structural Concrete.
12. ACI 347R - Guide to Formwork for Concrete.
13. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
18. ASTM C138 - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
   Cement Mortar and Concrete
23. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
24. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by
   the Volumetric Method.
25. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by
   the Pressure Method.
27. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds
   for Curing Concrete.
29. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural
   Pozzolan for Use inConcrete.
31. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in
   Producing Flowing Concrete.
32. ASTM C1059 - Standard Specification for Latex Agents for Bonding Fresh to
   Hardened Concrete.
33. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic
   Cement Concrete.
34. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete
35. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout
   (Nonshrink).
36. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for
   Concrete Paving and Structural Construction (Nonextruding and Resilient
   Bituminous Types).
37. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.
38. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact
   with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
   Inspection, Testing, or Special Inspection.
40. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in
   Contact with Soil or Granular Fill under Concrete Slabs.

1.4 TESTING AND INSPECTION

A. Special Inspection and Testing:
   1. In accordance with Chapter 17 of the International Building Code, the Owner shall
      employ a Special Inspection Agency to perform the duties and responsibilities
      specified in Section 1704.0.
   2. Refer to architectural, civil, mechanical, and electrical specifications for testing and
      inspection requirements of non-structural components.
   3. Work performed on the premises of a fabricator approved by the building official
      need not be tested and inspected per the table below. The fabricator shall submit
      a certificate of compliance that the work has been performed in accordance with
      the approved plans and specification to the building official and the Architect and
      Engineer of Record.
4. Duties of the Special Inspection Agency:
   a. Perform all testing and inspection required per the Testing and Inspection Schedule indicated below.
   b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.
   c. Submit a final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency’s knowledge in conformance with the approved plans and specifications.

5. Structural Component Testing and Inspection Schedule for Section 03 30 00 is as follows:

<table>
<thead>
<tr>
<th>Concrete and Concrete Placement</th>
<th>Continuous</th>
<th>Periodic</th>
<th>Referenced Standard</th>
<th>IBC Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review of proposed mix design and supporting test results</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspect anchors cast in concrete</td>
<td>X</td>
<td></td>
<td>ACI 318: 17.8.2</td>
<td></td>
</tr>
<tr>
<td>Inspect anchors post-installed in hardened concrete members.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads.</td>
<td>X</td>
<td></td>
<td>ACI 318: 17.8.2.4</td>
<td></td>
</tr>
<tr>
<td>B. Mechanical anchors and adhesive anchors not defined in row above.</td>
<td>X</td>
<td></td>
<td>ACI 318: 17.8.2</td>
<td></td>
</tr>
<tr>
<td>Verify use of required design mix</td>
<td>X</td>
<td></td>
<td>ACI 318: Ch. 19, 26.4.3, 26.4.4</td>
<td>1904.1, 1904.2</td>
</tr>
<tr>
<td>Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.</td>
<td>X</td>
<td></td>
<td>ASTM C172, ASTM C31, ACI 318: 26.4, 26.12</td>
<td></td>
</tr>
<tr>
<td>Inspection of concrete placement for proper application techniques</td>
<td>X</td>
<td></td>
<td>ACI 318: 26.5</td>
<td></td>
</tr>
<tr>
<td>Verify maintenance of specified curing temperature and techniques.</td>
<td>X</td>
<td></td>
<td>ACI 318: 26.5.3-26.5.5</td>
<td></td>
</tr>
<tr>
<td>Verify in-situ concrete strength prior to removal of shores and forms from beams and structural slabs</td>
<td>X</td>
<td></td>
<td>ACI 318: 26.11.2</td>
<td></td>
</tr>
</tbody>
</table>

B. Sampling and testing requirements:

1. Maintain records verifying materials used are of the specified and accepted types and sizes and are in conformance with the requirements of the Contract Documents.
2. Use of testing services will not relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

3. Take samples of fresh concrete at the job site for each mix design placed each day. Sampling and testing shall be done after the final addition and proper mixing of any water or admixtures that are added on site.
   a. Personnel and testing equipment shall meet the requirements of ASTM E329.
   b. Testing Frequency: Obtain at least one composite sample for each 150 cu. yd. or 5,000 sq. ft. of surface area, whichever is less or fraction thereof of each concrete mixture placed each day.
   1) On a given project, if the total volume of concrete is such that the frequency of testing required above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
   c. A strength test shall be the average of the strengths of two 6x12 inch or three 4x8 inch cylinders made from the same sample of concrete and tested at 28 days.

4. For each sample of fresh concrete, perform the following duties:
   a. Measure and record slump in accordance with ASTM C143.
   b. Measure and record temperature in accordance with ASTM C1064.
      1) Provide one test hourly when air temperature is 40°F and below and when 80°F and above, and one test for each composite sample.
   c. Measure and record air content by volume in accordance with either ASTM C231 or ASTM C173.
   d. Mold two 6x12 inch or three 4x8 inch cylinders (laboratory cylinders) in accordance with ASTM C31 to be laboratory-cured. Protect from moisture loss and maintain at 60°F to 80°F for 24 to 48 hours before moving. Deliver cylinders to testing laboratory for curing and testing.
   e. Mold one cylinder (field cylinder) in accordance with ASTM C31 to be field-cured. Field cylinder shall be placed as near as possible to the in-place concrete from which it was taken, protected, and cured in the same manner. Deliver field-cured cylinder to testing laboratory, and measure and record compressive strength in accordance with ASTM C39. Field cylinder shall be used to determine if concrete footings, walls, or piers have reached the required compressive strength for steel erection to begin.

5. Measure and record compressive strength in accordance with ASTM C39 for laboratory cylinders. Test one laboratory cylinder at 7 days and all other cylinders at 28 days. Acceptance is based on the average of the two 6x12 inch or three 4x8 inch laboratory cured 28-day tests. Notify Architect in the event strength levels do not meet the acceptance requirements of ACI 318.
a. Any additional cylinders molded for Contractor to have a compressive strength test done before seven days shall be at the Contractor's expense.

6. Prepare and submit test reports to the Architect, Engineer, Contractor, and Supplier. Reports shall be completed and furnished within 48 hours of testing. Refer to description in Submittals.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

8. Should the strength of any grade of concrete for any portion of work, as indicated by molded test cylinders, fall below the minimum 28-day compressive strength specified on the drawings, upon approval of the Structural Engineer of Record (SEOR), the concrete supplier shall adjust the concrete mix for remaining portion of construction so that the resulting concrete meets the minimum strength requirements.

1.5 SUBMITTALS

A. Concrete Materials: Submit information on concrete materials as listed below.

1. Cementitious materials: Submit type, class, producer name, and certification not more than 90 days old of compliance with applicable ASTM standard.

2. Aggregates: Submit type, pit or quarry location, producer name, gradations, specific gravity, water content, and certification not more than 90 days old.

3. Admixtures: Submit product data sheet. Product data shall include: dosages and performance data, brand names, producers, chloride ion concentrations, and certifications of compliance with applicable ASTM standard. Certifications shall not be more than 90 days old.

4. Water: Submit name of source.

B. Product Data: Prepare and submit product and performance data for materials and accessories, including patching compounds, joint systems, curing compounds, finish materials and other concrete related items.

C. Testing Agency Qualifications: When requested, the proposed testing agencies shall submit data on qualifications for acceptance.

D. Concrete Mix Design:

1. Concrete mix design submittals shall be submitted to the SEOR for review and approval at least 14 days prior to placing concrete.

2. Submit concrete mixture proportions and characteristics for each concrete mix. Include standard deviation analysis or trial batch data with mix design. Submit historical field test data to demonstrate the average compressive strength for approval. Concrete mix proportions, materials, and handling methods for field test data or trial batches shall be the same as used for the work. Include the following information for each mix design:

   a. Water/cementitious materials ratio.
   b. Slump per ASTM C143
c. Air content per ASTM C231 or ASTM C173
d. Unit weight of concrete per ASTM C138
e. Compressive strength at 28 days per ASTM C39

3. If trial batches are used, submit representative samples of each proposed ingredient to independent testing laboratory for use in preparation of mix design.

4. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Indicate amounts of mix water to be withheld for later addition at Project site.

5. Provide a record copy of the final mix designs and test results to the testing agency prior to commencement of the concrete work.

E. LEED Certification: Submit manufacturer’s certification for each concrete product including the following:

1. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer’s name, product cost and location of extraction or harvest of raw materials.

F. Concrete Finish Shop Drawings: Submit drawings indicating type of finish to be used at each location.

G. Slab-on-Grade Joint Layout: Submit drawings for proposed slab-on-grade control joint and construction joint layout for approval.

H. Construction Sequence Submittal: Contractor shall submit an elevated slab construction sequence indicating construction joints and the pour sequence.

I. Test Reports: Submit laboratory test reports for concrete materials, mix design, compressive strength, slump, air content, and temperature. Each report shall indicate date of sampling, date of test, mix design, and location of concrete in structure.

J. Repair Methods: When stains, rust, efflorescence, and surface deposits must be removed, submit the proposed method of removal.

K. Certificates: Submit written certification regarding the design mix from the ready-mix supplier and the admixture manufacturer stating all concrete and admixtures do not contain chloride ions in excess of concentrations specified herein.

L. Placement Notification: Notify the Architect at least 24 hours in advance of concrete placement.

M. Adjustments: Submit any adjustments to mixture proportions or changes in materials, suppliers, or sources, along with supporting documentation, during the course of the work.

N. Cold Weather Procedure Submittal: Refer to Cold Weather Concreting article in Part 3 for more information.

O. Record Documents: Accurately record actual locations of embedded utilities and components that are concealed from view.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Cementitious materials: Store cementitious materials in dry weather tight buildings, bins, or silos that exclude contaminants.
B. Aggregates: Store and handle aggregate in a manner that will avoid segregation and prevent contamination with other materials or other sizes of aggregates. Store aggregates so as to drain freely.

C. Admixtures: Protect stored admixtures against contamination, evaporation, or damage. Protect liquid admixtures from freezing and temperature changes, which would adversely affect their performance. Handle chemical admixtures in accordance with manufacturer’s instructions.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: Portland cement shall conform to ASTM C150, Type I Normal, and be a standard brand of Portland cement. Use one brand of cement throughout project, unless approved in writing by the Engineer. Cement, which conforms to ASTM C150 Type II, may be used if it also meets the requirements of ASTM C150 Type I. Cement used in concrete shall be of the same brand and type as the cement used in the concrete represented by the submitted field test data or used in the trial mixtures. Maintain consistent cement color throughout project unless directed otherwise by architectural requirements.

1. Total replacement of Portland cement by supplementary cementitious materials in design mixture shall not exceed 50% (by weight).

B. Supplementary Cementitious Materials

1. Fly Ash: Fly ash shall conform to ASTM C618, Class C or Class F. Replacement of Portland cement by fly ash shall not exceed the following (percentages are by weight):
   a. Concrete Flatwork: 20 percent.
   b. Mass Concrete (more than two feet thick): 50 percent.
   c. All other concrete: 25 percent.
   d. Concrete to be placed in cold weather as defined herein: No fly ash allowed unless the cold weather procedure submitted has compensated for the increased setting time and decreased rate of strength gain due to cold weather and fly ash.

2. Slag Cement: ASTM C989, Grade 100 or 120.
   a. Ground Granulated Blast-Furnace Slag Limit: 50% by weight of total cementitious materials.
   b. In mass concrete more than 2 feet thick, the usage rate may be 80% by weight of total cementitious materials.

3. Combined Fly Ash and Ground Granulated Blast-Furnace Slag:
   a. Supplementary Cementitious Materials Limit: 50% with fly ash not exceeding 25% by weight of total cementitious materials.
   b. In mass concrete more than 2 feet thick: 80% with fly ash not exceeding 50% by weight of total cementitious materials.
C. Coarse Aggregate for Normal Weight Concrete: Comply with ASTM C33. Provide coarse aggregate from a single source for exposed concrete. Gradations shall be similar to that described in the following table:

<table>
<thead>
<tr>
<th>GRADE</th>
<th>No. 1-1/2&quot;</th>
<th>1&quot;</th>
<th>3/4&quot;</th>
<th>1/2&quot;</th>
<th>3/8&quot;</th>
<th>No. 4</th>
<th>No. 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>90-100</td>
<td>20-55</td>
<td>0-15</td>
<td>---</td>
<td>0-5</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>100</td>
<td>95-100</td>
<td>---</td>
<td>25-60</td>
<td>0-10</td>
<td>0-10</td>
<td>---</td>
</tr>
<tr>
<td>67</td>
<td>100</td>
<td>90-100</td>
<td>---</td>
<td>20-55</td>
<td>0-10</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>89</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>100</td>
<td>90-100</td>
<td>20-55</td>
<td>0-10</td>
</tr>
</tbody>
</table>

1. Shall be 100 percent passing the 2" sieve.
2. A maximum of 30% of coarse aggregate may be recycled aggregate for footing and grade beam concrete.

D. Fine Aggregate for Normal Weight Concrete: Comply with ASTM C33. Provide fine aggregate from a single source for exposed concrete. Fine aggregate shall consist of washed sand. Gradations shall be similar to that described in the following table:

<table>
<thead>
<tr>
<th>GRADE</th>
<th>3/8</th>
<th>No. 4</th>
<th>No. 8</th>
<th>No. 16</th>
<th>No. 50</th>
<th>No. 80</th>
<th>No. 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA</td>
<td>100</td>
<td>95-100</td>
<td>80-100</td>
<td>50-85</td>
<td>5-30</td>
<td>---</td>
<td>0-10</td>
</tr>
</tbody>
</table>

1. A maximum of 10% of fine aggregate may be recycled aggregate for footing and grade beam concrete.

E. Do not use aggregates containing deleterious substances that could cause spalling on any exterior exposed surface. These include, but are not limited to the following:

1. Organic impurities.
2. Ferrous metals.
3. Soluble salts.
4. Coal, lignite, or other lightweight materials.
5. Soft particles.
7. Cherts of less than 2.40 specific gravity.

F. Water: Mixing water for concrete shall meet the requirements of ASTM C94. Water shall be clean and free from injurious amounts of acids, alkalis, organic materials, chloride ions and oils deleterious to concrete or reinforcing steel.

G. Testing agency shall be given access to plants and stockpiles to obtain samples for testing for compliance with the Contract Documents.
2.2 ADMIXTURES

A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures. Calcium chloride thiocyanates or admixtures containing intentionally added chlorides are not permitted.

B. Water Reducing Admixture: Material shall comply with ASTM C494, Type A. Acceptable manufacturers and products include:

1. BASF Corporation - MasterPozzolith Series or MasterPolyheed Series.
2. Euclid Chemical Company - Eucon WR Series.
3. Sika Chemical Corp. - Plastocrete 161.
4. GRT - Polymeth 400 NC.
5. Grace Construction Products - WRDA 82.

C. High Range Water Reducing Admixture (superplasticizer): Material shall comply with ASTM C494, Type F or Type G. Acceptable manufacturers and products include:

1. BASF Corporation - MasterRheobuild 1000 or MasterGlenium Series.
2. Euclid Chemical Company - Eucon 37 or Plastol Series.
4. GRT – Melchem.
5. Grace Construction Products - Mira 110.

D. High Range Water Reducing, Slump Retaining Admixture: Material shall comply with ASTM C494, Type F or Type G. Acceptable manufacturers and products include:

1. BASF Corporation - MasterGlenium 7700.
2. Euclid Chemical Company - Eucon 537, Eucon 1037, or Plastol Series.
4. GRT – Melchem – M.
5. Grace Construction Products – ADVA FLEX.

E. Non-Chloride Accelerator: Material shall comply with ASTM C494, Type C or Type E, and not contain a higher chloride ion concentration than municipal drinking water. Acceptable manufacturers and products include:

1. BASF Corporation - MasterSet FP 20 or MasterSet AC 534.
2. Euclid Chemical Company - Accelguard Series.
3. Sika Chemical Corp. - Sika Rapid-1.
4. GRT – Polymeth HE.
5. Grace Construction Products – Lubricon NCA.

F. Air Entraining Admixture: Air entraining admixture shall comply with ASTM C260, and be certified by the manufacturer to be compatible with other admixtures to be used. Acceptable manufacturers and products include:

1. BASF Corporation - MasterAir Series.
2. Euclid Chemical Company - Air-Mix or AEA Series.
3. Sika Chemical Corporation - Sika-Aer.
4. GRT – Polymeth VR.
5. Grace Construction Products - Darex II or Daravair 1000.
G. Set Accelerating Corrosion-Inhibiting Admixture: Admixture shall contain at least 30% calcium nitrite, while meeting the requirements of ASTM C494 as a Type C admixture. Acceptable manufacturers and products include:

1. BASF Corporation - MasterLife CI 30.
2. Euclid Chemical Company - Eucon CIA.
3. Grace Construction Products - DCI.

H. Admixtures used in concrete shall be the same brand, type, and dosage used in concrete represented by field test data or used in trial mixes.

### 2.3 CURING PRODUCTS

1. **Moisture Retaining Cover:** Plastic Film: Use 6 mil polyethylene film sheet materials that meet the requirements of ASTM C171.

2. White burlap-polyethylene sheet meeting ASTM C171.


4. **Moisture Retaining Fabric:** A naturally colored, non-woven, polypropylene fabric with a 4-mil, non-perforated reflective (white) polyethylene coating containing stabilizers to resist degradation from ultraviolet light. Fabric shall exhibit low permeability and high moisture retention. Acceptable manufacturers and products include:
   
   a. PNA Construction Technologies, Inc.: Hydracure S16.
   b. PNA Construction Technologies, Inc.: Hydracure M5.
   c. Reef Industries Incorporated: Transguard 4000.

B. **Dissipating Resin Curing Compound:** Clear, waterborne, membrane-forming curing compound complying with ASTM C309, Type 1, Class B shall be composed of hydrocarbon resins and dissipating agents that begin to break down upon exposure to ultraviolet light and traffic approximately 4 to 6 weeks after application, providing a film that is removable with standard degreasing agents, and mechanized scrubbing actions so as to not impair the later addition of applied finishes.

1. Curing compounds used on interior enclosed environments shall be a water-borne product and VOC compliant as required by the U.S. EPA Architectural Coating Rule.

C. **Non-dissipating Curing Compound:** Clear, membrane-forming curing compound complying with ASTM C309, Type 1, Class B.

1. Curing compounds used on interior enclosed environments shall be a water-borne product and VOC compliant as required by the U.S. EPA Architectural Coating Rule.

D. **Curing and Sealing Compound:** Clear, membrane-forming curing and sealing compound complying with ASTM C309, Type 1, and ASTM C1315, Type 1, Class A. Compound shall dry to a clear finish, resist yellowing due to ultraviolet degradation and provide a long-lasting finish that has high resistance to chemicals, oil, grease, deicing salts, and abrasion.

1. Curing and sealing compounds used on interior enclosed environments shall be a water-borne product and VOC compliant as required by the U.S. EPA Architectural Coating Rule.
2.4 MISCELLANEOUS MATERIALS

A. Patching Mortar: Non-shrink, non-slump, non-metallic, quick setting. Acceptable manufacturers and products:

1. Euclid Chemical Company - Eucospeed.
2. BASF Corporation - MasterEmaco N 424.
3. Adhesive Technologies - Hard Rok Vertipatch.
5. Dayton Superior – Re-Crete 20 minute.

B. Cement Grout: Mix 1 part Portland cement, 2-1/2 to 3 parts fine aggregate, and enough water for required consistency. Depending on use, consistency may range from mortar consistency to a mixture that will flow under its own weight. Do not mix more than the amount that can be used within 30 minutes. Retempering is not permitted. Use for leveling, preparing setting pads, beds, construction joints (with liquid bonding admixture) and similar uses. Do not use for grouting under bearing plates or structural members in place.

C. Dry-Pack: Mix 1 part Portland cement, 2 parts fine aggregate, and enough water to hydrate cement and provide a mixture that can be molded with the hands into a stable ball (a stiff mix). Do not mix more than the amount that can be used within 30 minutes.

D. Expansion Joint Material: Preformed, resilient, non-extruding asphalt-impregnated fiber conforming to ASTM D1751. Thickness of expansion joint material shall be 1/2” unless noted otherwise on the drawings.

E. Magnesium phosphate patching cement specially designed for cold weather grouting and anchoring. Acceptable Manufacturer:

1. BASF Corporation - MasterEmaco T545.
2. Euclid Chemical Company - Eucospeed MP.

F. Vapor Barrier: Refer to Section 07 27 00 – Underslab Vapor Barrier for product information.

G. Bonding Agent: “Weld-Crete” manufactured by the Larsen Products Corporation or “Nitobond Acrylic” manufactured by Fosroc Inc., or approved equivalent.

H. Anti-Bonding Agent: “Thompson’s Water Seal” as manufactured by A. E. Thompson, Inc., California or approved equivalent.

I. Control Joint Filler: Flexible, single-component polyurethane sealant with backer rod compliant with ASTM C 920, Type S, Grade P, Class 25. Apply sealant per manufacturers written recommendations. Acceptable manufacturers and products:

1. Dayton Superior – Perma 230 SL.
2. Euclid Chemical Company – Eucolastic I.
3. BASF Corporation - MasterSeal SL 1.

2.5 STRENGTH AND PROPERTIES

A. Concrete Mix Designs: Refer to drawings for specified compressive strength. Proportion concrete mixes according to the properties in the following tables. The concrete supplier may produce a mix at a lower water-cement ratio to allow for adjustment of slump at the site by adding water. The addition of site water shall be in accordance with ASTM C94, and the total water-cement ratio shall not exceed the value specified below.
### Class of Concrete

<table>
<thead>
<tr>
<th>Class</th>
<th>Coarse Aggregate Gradation</th>
<th>Fine Aggregate Gradation</th>
<th>Range of Slump</th>
<th>Max. w/c</th>
<th>Air Content</th>
<th>Other Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>57 or 67 FA</td>
<td>1&quot; to 4&quot;</td>
<td>0.45</td>
<td>5% to 8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>57 or 67 FA</td>
<td>1&quot; to 4&quot;</td>
<td>0.50</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>57 or 67 FA</td>
<td>4&quot; to 6&quot;</td>
<td>0.50</td>
<td>—</td>
<td>Use water reducing admixture to achieve slump specified</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>4 or 57 FA</td>
<td>1&quot; to 4&quot;</td>
<td>0.50</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>89 FA</td>
<td>5&quot; to 8&quot;</td>
<td>0.50</td>
<td>—</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: w/c = water-cementitious materials ratio.

### B. Schedule of Concrete Classes:

Provide concrete of the specified class according to the following schedule.

1. Formed Footings: Class E
2. Exterior foundation walls, trench footings, and piers: Class B
3. Interior piers: Class C
4. Interior slabs on grade: Class D
5. Floor topping: Class H
6. Unless noted otherwise: Class B

### C. Slump of Superplasticized Concrete:
Concrete containing high-range water reducing admixtures (superplasticizer) shall have 8" maximum slump, unless otherwise approved by Structural Engineer.

### D. Accelerators:
Add non-chloride accelerator to all concrete slabs placed at air temperatures below 50°F only when approved in the mix design. Use of admixtures will not relax cold weather placement requirements.

### E. Water Reducer:
Add water reducing admixture or high range water reducing admixtures (superplasticizers) as follows:

1. All pumped concrete.
2. Fiber reinforced concrete.
3. As required for placement or workability.
4. As required by high temperatures, low humidity, or other adverse placement conditions.
5. Concrete with water-cementitious materials ratio below 0.50.

### F. No other admixtures shall be used unless approved by SEOR.

### G. Chlorides:
Admixtures or other ingredients including aggregates containing calcium chloride or more than 0.05% chloride ions by weight shall not be used.

### H. Workability:
Concrete shall have a workability such that it will fill the forms without voids, honeycombs, or rock pockets with proper vibration without permitting materials to separate or excess water to collect on the surface.
I. Concrete Temperatures: Minimum concrete temperature of fresh concrete varies in relation to average air temperature over a 24-hour period as follows:

1. Air temperature below 0°F  Concrete temperature 70°F min.
2. Air temperature 0°F to 30°F  Concrete temperature 65°F min.
3. Air temperature 30°F to 50°F  Concrete temperature 50°F min.
4. Air temperature above 50°F  No minimum temperature

The maximum temperature of concrete at the time of delivery shall be 90°F. When concrete temperature exceeds 90°F, concrete supplier shall attempt to reduce temperature by shading aggregates and cement and cooling mix water. When these methods fail to reduce concrete temperature below 90°F, supplier shall use ice in the water to reduce the concrete temperature. Use set retarding admixtures only when approved in the mix design.

J. For integrally colored concrete, add color by weight directly into the mixer along with the aggregate, cement, and water. The pigment amount to be introduced to a batch must be determined by weight alone, not by volume, and by indication in the approved mix design.

2.6 LEED CREDITS

A. LEED Credit MRc 4.1/4.2 – Concrete flatwork shall contain at least 15% recycled cement (slag cement and fly ash). Concrete footings and drilled piers shall contain at least 50% recycled content. All other concrete shall contain at least 25% recycled cement.

B. LEED Credit MRc 5.1/5.2 – Concrete shall be manufactured within 500 miles of the project site. Aggregate, sand and water shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify requirements for concrete cover over reinforcement.

B. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

C. Do not place concrete until data on materials and mix designs have been approved, Architect has been notified, and all other affected trades have coordinated their work.

D. Remove snow, ice, frost, water, mud, and other foreign material from surfaces, reinforcing bars and embedded items against which concrete will be placed.

E. Prepare previously placed concrete by cleaning with sandblasting, steel brush, or water blast to expose aggregate to minimum 1/4” amplitude.

3.2 SLABS

A. Slab on Grade:

1. All interior slabs on grades shall have a vapor barrier beneath them. Refer to section 07 27 00 for installation information.

2. Refer to drawings and Section 31 23 00 for required sub-grade preparation beneath slabs on grade.
3. Where vapor retarder is not used below slab on grade, wet sub-grade below slab prior to placing concrete. Subgrade shall be moist with no free water and no muddy or soft spots.

4. Saw cut control joints: Cut with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Control joints shall be located along column lines, with intermediate joints spaced at a maximum distance of 36 times the slab thickness, unless noted otherwise. Control joints shall be continuous, not staggered or offset. Slab panels shall have a maximum length to width ratio of 1.5 to 1. Provide additional control joints at all reentrant or isolated corners formed in the slab on grade. Refer to drawings for typical control joint detail.

5. Provide isolation joints around each column, against trench footings and along foundation walls. Form isolation joints with 1/2" expansion joint material. Extend isolation joint material full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

6. Depress slabs as required for mats architectural finishes, pits and kitchen equipment. Obtain layout and locations from Architect.

7. Verify completion of all under slab work with mechanical and electrical trades before placing slabs.

8. Slope slabs as indicated on drawings and to provide positive drainage. Slope slab keeping bottom level and varying top. Maintain minimum thickness of concrete as indicated on drawings. Refer to floor finishes for tolerances.

B. All supported slabs, including slabs-on-steel decking and cast-in-place concrete slabs:

C. Embedded Items:

1. The outside diameter of embedded conduit or pipe shall not exceed one-third of the slab thickness in structural slabs, including at crossovers, and shall be placed between the top and bottom reinforcing with a minimum 3" clear cover. Conduit or pipe running parallel to each other shall be spaced at least 8" apart and no more than 2 runs stacked vertically in the slab. Conduit or pipe shall not be embedded in any supported slab less than 6" thick. No embedded conduit or pipe is allowed in any concrete slab-on-steel deck.

3.3 CONSTRUCTION JOINTS

A. Slabs: Where slab pour is to receive a subsequent topping or additional concrete, expose aggregate in top surface by brooming in two directions at right angles to each other.

B. Vertical: Locate vertical construction joints in walls and trench footings not farther than a maximum of 100 feet on center. Coordinate joint locations with architectural design.

C. Reinforcing: Stop all welded wire reinforcement and/or reinforcing at construction joint in slabs on grade and provide dowel bars as detailed. Provide reinforcement at other construction joints as detailed. Roughen and thoroughly clean the surface of the concrete, remove all laitance, and wet the surface before placing new concrete against the joint. Slush vertical joints with a neat cement grout before placing new concrete. Roughen entire surface at construction joints to remove surface paste and expose aggregate.
D. Wall Control Joints: Locate vertical control joints in exposed walls at a minimum uniform spacing not to exceed 25 feet-0 inches. Coordinate joint locations with architectural drawings.

E. Exposed Surfaces: Locate construction joints only at predetermined locations approved by the Architect and the SEOR.

3.4 CONCRETE PLACEMENT

A. Place concrete as continuously as possible until placement is complete. Do not place against concrete that has attained initial set, except at authorized joints. If, for any reason, concrete pour is delayed for more than 45 minutes, bulkhead off pour at last acceptable construction joint. Immediately remove excess concrete and clean forms.

B. Do not begin to place concrete during periods of rain, sleet or snow unless adequate protection is provided.

C. No concrete shall be cast onto or against sub-grades containing free water, frost, ice or snow. If earth at bottom of forms has dried out, rewet so the soil is moist, but free of standing water and mud.

D. Notify the architect in advance if concrete is to be pumped.

E. Do not place concrete until all reinforcement is in place, forms have been thoroughly cleaned and approval has been given.

F. Do not accept concrete delivered to the job site more than 90 minutes after initial mixing.

G. Concrete from its point of release to mixers, hoppers, or conveyances, shall not be permitted to drop more than 5 feet (10 feet for concrete containing high range water reducers). Deposit concrete directly into conveyances and directly from conveyances to final points of deposit. Sufficient transportation equipment in good working order shall be on hand before work begins. All conveying equipment must be clean and kept clean during concreting operations. Take every possible precaution to prevent segregation or loss of ingredients.

H. Regulate rate of placement so concrete surface is kept level throughout; a minimum being permitted to flow from one area to another. Use tremie heads spaced at approximately 10-foot intervals for placing concrete in walls. Control rate of placement consistent with form design.

I. Deposit concrete in one continuous operation until section being placed has been completed. For slab thicknesses greater than 12 inches, prevent excessive segregation of aggregate and high temperatures in accordance with ACI 304 and ACI 308. Place concrete in wall forms in layers not greater than 12 inches in depth, each layer being compacted by internal vibration before succeeding layer is placed.

J. Place concrete as near as possible to its final position to prevent segregation or loss of materials. Do not use vibrators to transport concrete within forms. Consolidate concrete in walls, columns, beams and slabs or joist construction thicker than 8" with internal vibrators (8,000 to 12,000 VPM). Slabs less than 8" thick may be consolidated with internal vibrators (9,000 to 13,500 VPM) or vibrating screeds supported on forms, boards or rails, approved by SEOR, supplement vibration by forking or spading by hand along surfaces adjacent to forms and construction joints. Be sure an adequate number of operating vibrator units are on hand to properly consolidate quantity of concrete to be placed, including spares for emergency use.
1. Vertically insert and remove handheld vibrators at constant intervals 18 to 30 inches apart. Vibrate concrete the maximum amount and time required for complete consolidation, without segregation, and release of entrapped air bubbles, but in no instance exceed 15 seconds per square foot of exposed surface.

K. Place concrete during daylight hours, unless permitted otherwise by the SEOR.

L. Re-tempering of concrete shall not be permitted. Concrete that has stood more than 15 minutes after leaving the mixer shall be discarded.

M. Exercise care in placing concrete over waterproof membranes, rigid insulation and/or protection boards to avoid damaging those materials. Report damage immediately, and do not proceed until damage is repaired.

N. Remove loose debris from hardened surfaces of previous pours, thoroughly wet and slush with a neat cement grout immediately before placing new concrete, or apply bonding compound to surface and let dry before placing new concrete.

O. Protect existing concrete work to be exposed to view and other finished materials from damage and staining resulting from concreting operations. Handle concrete carefully to avoid dripping and spillage. Remove spilled concrete from existing surfaces immediately. Covering sills, ledges, and other surfaces with protective coverings may be necessary to protect the work.

P. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

Q. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor rods for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

R. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on drawings. Screed, tamp, and trowel-finish concrete surfaces.

### 3.5 CONCRETE FINISHES AND TOLERANCES

A. Exposed Smooth Formed Surfaces: Remove forms and perform necessary repairs and patch to produce surface finish-3.0 as specified in ACI 301. Apply the following to smooth-formed finished concrete exposed to view in the finished work. Confirm finishes with architect prior to concrete placement by submitting shop drawings indicating locations of all types of finishes.

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.
3.6 CONCRETE SLAB FINISHES AND TOLERANCES

A. Trowel Finish:
   1. Screed concrete to an even plane, float, then power trowel the surface.
   2. Hand trowel the surface smooth and free of trowel marks. Continue hand troweling until a ringing sound is produced as the floor is troweled.
   3. Provide trowel finish as indicated on the drawings and at the following locations:
      a. Concrete floors exposed in finished work unless otherwise indicated.
      b. Slabs to receive curing compounds and sealers.
      c. Slabs to receive resilient flooring or carpet.

B. Fine Broom Finish:
   1. Screed concrete to an even plane, float, then power trowel the surface. Provide fine hair broom finish perpendicular to slope, free of loose particles, ridges, projections, voids and concrete droppings.
   2. Provide fine broom finish as indicated on the drawings and at the following locations:
      a. Stoop slabs.
      b. Raised curbs and walkway areas.
      c. Slabs to receive thin set ceramic tile.

C. Broom Finish:
   1. Screed concrete to an even plane and then float. Immediately after concrete has received a floated finish, give the concrete surface a coarse transverse scored texture by drawing a coarse broom across the surface.
   2. Provide as indicated on the drawings and at the following locations:
      a. ADA ramp slabs.
      b. Exterior walkway slabs.

D. Float Finish:
   1. Screed concrete to an even plane then float.
   2. Provide as indicated on the drawings and at the following locations:
      a. Slabs to directly receive concrete topping.
      b. Roof slabs to receive loose laid roof insulation.

E. Floor Finish Tolerances: Floor finish tolerances shall be measured by placing a freestanding (unleveled) 10-foot straightedge anywhere on the slab and allowing it to rest upon two high spots within 72 hours after placement of slab and removal of shoring (if
The gap at any point between the straightedge and the floor (and between the high spots) shall not exceed:

1. Slab on Grade (Office, School): 1/4"

F. Slab Drainage: Finish all concrete slabs to proper elevations to ensure that all surface moisture will drain freely to floor drains, and that no puddle areas exist. Contractor shall bear the cost of corrections to provide positive drainage.

G. Special Tolerances for Concrete Slabs: No abrupt change in vertical elevation of 1/4" or more is acceptable at the interface between slabs and within areas where pedestrian traffic is expected:

3.7 CONCRETE CURING

A. Freshly placed concrete shall be protected from premature drying and excessively hot temperatures.

B. Concrete other than high-early strength shall be maintained above 50°F and in a moist condition for at least the first 7 days after placement, except when special curing is used. Special curing procedures shall not be used without written permission from the SEOR.

C. Formed surfaces shall be cured by leaving the formwork in place during the curing period.

D. Protect concrete from excessive changes in temperature during the curing period and at the termination of the curing process. Changes in the temperature of the concrete shall be as uniform as possible and shall not exceed 5°F in any one hour or 50°F in any 24-hour period.

E. Protect concrete from injury from the elements until full strength is developed. Protect from mechanical injury.

F. During cold weather construction, all spread footings, continuous footings, and trench footings shall be protected from frost penetration until the building is enclosed and temporary heat is provided.

3.8 SLAB CURING

A. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface. Use one of the methods described below.

B. Moisture-Retaining-Cover Curing for Concrete Floors Not Exposed in Final Condition: Cover concrete surface with waterproof sheet material as soon as finishing operations are complete and the concrete is sufficiently hard to be undamaged by covering. The cover shall be placed flat on the concrete surface, avoiding wrinkles. Sprinkle concrete with water as necessary during application of covering. Place in widest practicable width, with sides and ends lapped at least 12 inches, and seal with waterproof tape or adhesive. Verify that the concrete is continuously wet under the sheets; otherwise, add water through soaker hoses under the sheets. Weight down covering to prevent displacement. Immediately repair any holes or tears during the curing period using polyethylene sheet and waterproof tape. Curing process shall be maintained for a minimum of 7 days.

C. Moisture-Retaining-Fabric Curing for Concrete Floors to Remain Exposed: Cover concrete surface with moisture retaining fabric as soon as finishing operations are complete and the concrete is sufficiently hard to be undamaged by covering. The cover shall be installed in accordance with manufacturer’s written recommendations, in largest practical widths. Wet
the slab to rejection, then thoroughly wet fabric side of cover and install with poly side up. Lap over adjacent covers a minimum of 18”. Wet all laps and outside edges to prevent displacement and to ensure intimate contact with concrete and adjacent covers. Rewet as necessary and protect covers from damage during curing process.

1. After minimum 7-day cure, remove moisture retaining fabric in sections.

2. A maximum of 3,500 square feet of concrete curing cover may be removed at any one time. At no time shall the exposed area be permitted to dry prior to completion of the floor scrubbing process.

3. Using a high-powered floor scrubber capable of a minimum 80 pounds head pressure, and a mild citrus-based detergent that does not damage or mar the surface in any way, scrub the floor to remove any minerals or soluble salts that may have accumulated at the floor surface. Rinse area thoroughly with clean fresh water. Remove water and allow floor to dry. If whitening occurs during drying, repeat scrubbing process before floor dries until no whitening occurs during drying.

4. All areas of the floor shall remain wet during floor scrubbing process. Expose only the amount of floor surface that can be cleaned before any drying occurs without exceeding the maximum allowable exposed area.

D. Curing Compound: Apply uniformly in continuous operation by low pressure spray equipment or roller as soon as finishing operations are complete, free water on the surface has disappeared and no water sheen can be seen. Follow the manufacturer's written instructions. Recool areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. Verify compatibility of the curing compound with paint, finishes, or toppings that require positive bond to the concrete. If curing compound is not compatible with paint finishes or toppings, utilize a dissipating curing compound and remove in accordance with the manufacturer's recommendations.

3.9 PENETRATING LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer’s written instructions.

B. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs in accordance with manufacturer’s written instructions.

C. Do not apply to concrete that is less than seven days old.

D. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.10 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

B. Do not fill joints until construction traffic has permanently ceased.

C. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
D. Install semi-rigid joint filler in saw-cut joints and in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.11 APPLICATION OF FLOOR SEALER - FINISH COAT

A. Give concrete floors as indicated in Room Finish Schedule and where exposed in finished Work, second coat of curing and sealing compound immediately prior to Substantial Completion.

B. Clean floors and apply sealer strictly according to manufacturer's instructions. Dilution and coverage shall be as recommended by the manufacturer. Apply sealer evenly.

3.12 COLD WEATHER CONCRETING

A. Definition: Cold weather shall be defined as a period when for more than three successive days the average daily outdoor temperature drops below 40°F. The average daily temperature is the average of the highest and lowest temperature during the period from midnight to midnight. When temperatures above 50°F occur during more than half of any 24-hour duration, the period shall not be regarded as cold weather.

B. All cast-in-place concrete work occurring during cold weather shall conform to all requirements of ACI 306.1, “Standard Specification for Cold Weather Concreting”, published by the American Concrete Institute, Detroit, Michigan, except as modified by the contract documents or this specification.

C. Planning: The General Contractor, concrete contractor, concrete supplier and the architect shall have a pre-construction conference to outline the cold weather concreting operations concerning the placing, finishing, curing and protection of the concrete during cold weather. Pre-construction conference shall occur before cold weather is expected to occur.

D. Detailed procedure submittal: Concrete contractor shall prepare and submit for review detailed procedures for the production, transportation placement, protection, curing and temperature monitoring of concrete during cold weather. Include procedures to be implemented upon abrupt changes in weather conditions. Do not begin cold weather concreting until these procedures have been reviewed and approved.

E. Mixing: Concrete flatwork poured in cold weather shall be proportioned to obtain a lower slump to minimize the amount of bleed water during finishing. All bleed water should be skimmed off flatwork prior to troweling. Concrete that will be exposed to cycles of freezing and thawing while saturated should be properly air entrained as outlined in this specification.

F. Protection of Concrete: Cure and protect concrete against damage from freezing for a minimum period of 72 hours, unless approved by the structural engineer. The protection period may be reduced according to ACI 306.1 requirements. Concrete contractor shall submit a letter of request to reduce the protection period, by outlining the method used to achieve the reduction per ACI 306.1.

1. When practical for the construction schedule, formwork shall be insulated and remain in place for at least the required protection period.
G. Concrete Temperatures: The minimum temperature of concrete immediately after placement shall be as specified in the following table.

<table>
<thead>
<tr>
<th>Section Size</th>
<th>Minimum temperature of concrete as placed and maintained during the protection period</th>
<th>Maximum gradual decrease in surface temperature during any 24 hours after the end of the protection.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 12 in</td>
<td>55°F</td>
<td>60°F</td>
</tr>
<tr>
<td>12-36 in</td>
<td>50°F</td>
<td>55°F</td>
</tr>
<tr>
<td>36-72 in</td>
<td>50°F</td>
<td>50°F</td>
</tr>
<tr>
<td>&gt; 72 in</td>
<td>50°F</td>
<td>45°F</td>
</tr>
</tbody>
</table>

H. Mixing Temperatures: As the ambient air temperature decreases the concrete mixing temperature shall be increased to compensate for the heat lost in the period between mixing and placement. The concrete supplier shall use one or both of the following methods for increasing the concrete temperature.

1. Heating the mixing water to a temperature necessary to offset the temperature losses during transport. Supplier shall not heat water to temperatures in excess of 140°F, without taking special precautions as outlined in ACI 306.

2. Heating the aggregate with a circulated steam piping system.

I. Temperature measurements: The Contractor shall be responsible for monitoring and recording the concrete temperatures during placement and throughout the protection period.

1. Inspection personnel shall keep a record of the date, time, outside air temperature, temperature of concrete as placed, and weather conditions.

2. Temperature of the concrete and the outside air shall be recorded at regular intervals but not less than twice in a 24-hour period. The record shall include temperatures at several points within the enclosure and on the concrete surface of sufficient frequency to determine a range of temperatures.

3. Inspection agency shall submit the temperature logs to the Architect for permanent job records.

### 3.13 HOT WEATHER PROTECTION

A. Definition: Hot weather shall be defined as any combination of high ambient temperature, low relative humidity, high winds and intense solar radiation that leads to higher than usual evaporation. The table below defines low relative humidity based on air temperature. For a given air temperature, if the relative humidity is equal to or less than the specified minimum, provisions for hot weather concreting shall be as follows:

<table>
<thead>
<tr>
<th>Air Temperature</th>
<th>Minimum Relative Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>105°F</td>
<td>90%</td>
</tr>
<tr>
<td>100°F</td>
<td>80%</td>
</tr>
</tbody>
</table>
### B. Scheduling:
When hot weather is expected, adjust concrete placement schedules to avoid placing or finishing during the period from noon until 3:00 pm. When possible, slab pours should be delayed until the building is enclosed to protect the concrete from wind and direct sunlight. Construction schedule shall account for 7-day moist curing period.

### C. Mixing:
Concrete supplier shall adjust mix designs and admixtures to minimize slump loss. Concrete shall be mixed at a water-cement ratio which is lower than the specified maximum to allow for the adjustment of slump by addition of water in the field. Water reduction shall be accomplished without reducing initial slump by increasing dosage of water reducing admixture.

### D. Preparation:
Do not order concrete earlier than is required to avoid delays. Cool forms, subgrades and reinforcing bars with water spray from fog nozzle prior to concrete placement.

### E. Delivery:
Site traffic shall be coordinated and delivery times scheduled to minimize waiting times for concrete trucks.

### F. Placement:
Preparations shall be made to place and consolidate the concrete at the fastest possible rate. Maintain a continuous flow of concrete to the job site to avoid development of cold joints. During placement of slabs, apply fog spray to prevent moisture loss without causing surplus water to stand on concrete surface.

### G. Finishing:
Finish concrete as fast as practical. Continue fogging concrete during finishing. Where fogging is not possible, apply sprayable moisture-retaining film between finishing passes.

### H. Curing:
Formed concrete shall be covered with a waterproof material to retain moisture. Flat work shall be moisture cured as described in this specification. Moist curing shall continue for at least 7 days.

### 3.14 FIELD QUALITY ASSURANCE

#### A.
Independent Testing Agency and Special Inspector shall each perform their prescribed inspection, sampling, and testing services as described in Part 1 of this specification section.

#### B.
In cases where samples have not been taken or tests conducted as specified or strength of laboratory test cylinders for a particular portion of the structure fails to meet requirements of ACI 301, for evaluation of concrete strength, Structural Engineer shall have the right to order compressive or flexural test specimens or both be taken from the hardened concrete according to ASTM C42, load tests according to ACI 318, or such other tests as may be necessary to clearly establish the strength of the in situ concrete, and such tests shall be paid for by the Contractor. Where cores have been cut from work, Contractor shall fill void with dry-pack and patch the finish to match the adjacent existing surfaces.
3.15 REPAIR OF DEFECTIVE AREAS

A. All repair of defective areas shall be made, with prior approval of Architect and SEOR as to method and procedure, in accordance with Section 5 of ACI 301, except specified bonding compound must be used. Cosmetic repairs of minor defects in exposed concrete surfaces shall be in a manner acceptable to the Architect. Defective areas shall be deemed when:

1. Tests on core or prism specimens fail to show specified strengths.
2. Not formed as indicated or detailed.
3. Not plumb or level where so indicated or required to receive subsequent work.
4. Not true to intended grades and levels.
5. Cut, filled, or resurfaces, unless under direction of the SEOR.
6. Debris is embedded therein.
8. Damaged by hot or cold weather conditions.
9. Mixing time exceeds 90 minutes from ready-mix plant to the time of deposit.

B. Patch form tie holes at the following locations:

1. Unfinished exposed concrete (not scheduled for painting, plus at board formed concrete finish).
2. All other areas: Prime voids with bonding compound and fill with patching mortar. Strike flush without overlap, float to uniform texture to match adjacent surfaces.
3. Exposed areas scheduled for spray texture:
   a. Remove projections and protrusions: 1/16" or larger.
   b. Remove continuous ridges 1/32" or larger.
   c. Fill voids and pin holes.
4. Exposed areas scheduled for paint or epoxy:
   a. Remove projections, ridges, and other protrusions 1/32" or larger.
   b. Fill voids and pin holes 1/16" or larger.
5. Exposed areas not scheduled for paint or other finishes:
   a. Remove projections, ridges and other protrusions not conforming to requirements specified under Section 03 10 00.
   b. Fill voids and pin holes not conforming to requirements specified under Section 03 10 00.

C. All structural repairs shall be made, with prior approval of the Architect/Engineer, as to method and procedure, using the specified epoxy adhesive and/or epoxy mortar.

D. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with
patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

E. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
3.16  CEMENT GROUT AND DRY-PACK

A. Cement Grout: Thoroughly mix sufficient quantities to avoid combining different batches of grout mix. Ensure that grout completely fills all spaces and voids. Level, screed, or cut flush excess grout to produce smooth, neat, even exposed surfaces.

B. Dry-Pack: Thoroughly blend dry ingredients prior to mixing with water. Forcibly pack mixture to complete fill voids and spaces.

3.17  CLEANING

A. Clean exposed concrete to remove laitance, efflorescence and stains.

END OF SECTION 03 30 00
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section Includes: Products and procedures for diamond polishing concrete floors using multi-step wet/dry mechanical process, and accessories indicated, specified, or required to complete polishing.

1.2 RELATED SECTIONS

A. Section 03 30 00 Cast-in-Place Concrete for preconstruction meeting and floor flatness requirements.
B. Section 01 73 00 Execution for protection by General Contractor of floor from damage and stains prior to and after concrete polishing.
C. Section 01 81 13.14 “Sustainable Design Requirements” for LEED information.

1.3 REFERENCES

A. ANSI 137.1/A326.3 Tile Slip Test.

1.4 SUBMITTALS

A. Comply with Section 01 30 00 - Submittal Procedures.
B. Submit manufacturer's product data and application instructions.
   1. Provide documentation showing finisher is certified by the polishing and densifier manufacturer.

1.5 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Manual: At closeout, submit installer's maintenance manual, including maintenance and cleaning instructions for polished concrete floor system.
   1. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.
1.7 QUALITY ASSURANCE

A. Polisher Qualifications
   1. Use CPC certified polisher and adequate number of skilled personnel who are thoroughly trained and experienced in the floor treatment.
   2. The applicator to have minimum of 10 projects performed within 3 years of similar type, size and complexity as this contract.

B. Dynamic Coefficient of Friction: Achieve not less than 0.42 for level floor surfaces as determined by quality control testing according to ANSI A137.1.

C. Mock-Ups
   1. Apply Mock-up of required finish to demonstrate surface finish, color variations and to determine level of workmanship. There will be 1 mock-up(s) for this project.
   2. Build Mock-up in location and dimensions as directed by architect or owner’s representative.
   3. Prior to proceeding, ensure Mock-up meets requirements of architect or owner’s representative.
   4. Maintain Mock-up during construction in undisturbed condition as standard for judging work.

D. Provide name of technically qualified concrete polishing field representative.

E. Provide name of technically qualified densifier manufacturer’s field representative.

F. Ensure correct amount of densifier is on-site.

G. Pre-Installation Conference for Polished Concrete:
   1. Conduct conference at project site. Require representatives of each entity directly concerned with cast-in-place concrete floor polishing to attend, including the following:
      a. Contractor's superintendent.
      b. Concrete subcontractor.
      c. Concrete finisher, including supervisor.
      d. Concrete polisher, including supervisor.
      e. Technical representative of liquid applied product manufacturer.
      f. Walkway auditor.
   2. Minimum Agenda: Polisher to demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
      a. Tour mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
      b. Review Contract Document requirements.
      c. Review approved submittals.
      d. Review procedures, including, but not limited to:
         1) Details of each step of grinding, honing, and polishing operations.
         2) Application of liquid applied products.
         3) Protecting concrete floor surfaces until polishing work begins.
         4) Protecting polished concrete floors after polishing work is completed.
   3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.
1.8 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
B. Store materials in a clean dry area in accordance with manufacturer's instructions.
C. Keep product from freezing.
D. Avoid direct contact with this product as it may cause mild to moderate irritation of the eyes and/or skin.
E. Protect materials during handling and application to prevent damage or contamination.

1.9 ENVIRONMENTAL REQUIREMENTS
A. Do not apply product when air, surface, or material temperatures are expected to fall below 40°F (4°C) within 4 hours of expected application.
B. Do not apply to frozen concrete.
C. Do not use on highly dense or non-porous surfaces.
D. Limit and control damage from excessive dust caused by grinding/polishing procedure.
E. Properly dispose of collected dry dust from polishing.

PART 2 PRODUCTS

2.1 AIR QUALITY
A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 MANUFACTURERS
B. Ameripolish, 120 Commercial Avenue, Lowell, Arkansas, 72745. (800) 592-9320. Fax (479) 725-0031. Website: www.ameripolish.com
E. Substitutions allowed in accordance with Section 00 26 00.

2.3 LIQUID APPLIED PRODUCTS
A. Liquid Densifier: Odorless, non-hazardous, silicate that penetrates concrete to react with free lime and calcium hydroxide to produce permanent chemical reaction that hardens and densifies concrete surface.
B. Polish Guard: Non-film forming, stain resistant, food resistant, chemical stain resistant, impregnating sealant designed for use on previously densified concrete surfaces.

2.4 ACCESSORIES

C. Patching Compound: Compound composed of 40 percent portland cement, 45 percent limestone, and 15 percent vinyl acetate copolymer, when mixed with dust salvaged from grinding process forms paste that hardens when surface imperfections are filled.

D. Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.

E. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with multi-ply, textured membrane, not less than 18 mils thick.

2.5 POLISHING EQUIPMENT

A. Field Grinding and Polishing Equipment:
   1. Variable speed, multiple head, counter-rotating, walk-behind machine with not less than 600 pounds of down pressure on grinding or diamond polishing pads.
   2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.

B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.

C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

D. Metal Bonded Pads: Grinding pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.

E. Resin Bonded Pads: Polishing pads with embedded industrial grade diamonds of varying grits fabricated for mounting on equipment.

F. Burnishing Pads: Maintenance pads for use with high speed burnishing equipment.

PART 3 EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Cleaning New Concrete Surfaces:
1. Prepare and clean concrete surfaces.
2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.
3. Review test reports as completed under provisions of Section 09 05 12.
   a. pH Acceptable Results: pH between 8 and 10.
   b. Moisture Vapor Transmission Acceptable Results: Not more than 5 pounds per 1000 square feet in 24 hours.
   c. Relative Humidity Acceptable Results: Not more than 75 percent.

### 3.4 POLISHING CONCRETE FLOORS

A. Sequence of Polishing: Perform polishing after partition studs are erected but before gypsum board is installed.

B. Initial Grinding:
   1. Use grinding equipment with metal bonded grinding pads.
   2. Begin grinding in one direction using sufficient size grit pad.
   3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 150 grit. Hand grind corners and edges.
   4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
   5. Vacuum floor using squeegee vacuum attachment after each pass.
   6. Continue grinding until aggregate exposure matches approved field mock-ups.

C. Treating Surface Imperfections:
   1. Mix patching compound and grout material with dust created by grinding operations to match color of adjacent concrete surface.
   2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids.
   3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

D. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow to cure according to manufacturer’s instructions.

E. Grout Grinding:
   1. Use grinding equipment and appropriate grit grinding pads.
   2. While applying fresh grout material prior to, grind concrete in direction perpendicular to initial grinding to remove scratches. Hand grind corners and edges.
   3. Vacuum floor using squeegee vacuum attachment after each pass.

F. Honing:
   1. Use grinding equipment with resin bonded grinding pads.
   2. Grind concrete in one direction starting with 50 grit pad and make as many sequential passes required to remove scratches, each pass perpendicular to previous pass, up to 400 grit pad reaching maximum refinement with each pass before proceeding to finer grit pads. Hand grind corners and edges.
   3. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.

G. Polishing:
   1. Use polishing equipment with resin bonded polishing and burnishing pads.
   2. Begin polishing in one direction starting with 800 grit pad.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit pad with each pass, up to 3000 grit. Hand polish corners and edges.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Auto scrub or vacuum floor using squeegee vacuum attachment after each pass.
6. Continue polishing until gloss appearance, as measured according to ASTM E 430, matches approved field mock-ups.

H. Polish Guard: Uniformly apply and remove excessive liquid according to manufacturer's instructions.

I. Final Polish: Using burnishing equipment and finest grit burnishing pads, burnish to uniform sheen matching approved mock-up. Hand polish corners and edges.

J. Final Polished Concrete Floor Finish:
1. Class C – Medium Aggregate Finish: Remove not more than 1/8 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying medium aggregate with no, or small amount of, large aggregate at random locations.
2. Level 2 – Stain (Honed):
   1. DOI Gloss: Object reflections have matte appearance.
   2. Image Clarity Value: 10-39% as measured by Image Clarity Meter in accordance with ASTM D5767.
   3. Haze Index: <10 as measured by Glossmeter in accordance with ASTM D4039.
   4. Procedure: Not less than 5 step process with full refinement of each diamond pad up to 800 grit resin bonded pad with one application of densifier.
   5. Gloss Reading: Not less than 55 according to ASTM E 430 before polish guard application.

3.5 FIELD QUALITY CONTROL

A. Field Testing: Engage qualified walkway auditor to perform field testing according to NFSI 101-A to determine if polished concrete floor finish complies with specified static coefficient of friction.

3.6 CLOSEOUT ACTIVITIES

A. Maintenance Training: Polishing Contractor to train Owner's designated personnel in proper procedures for maintaining polished concrete floor.

3.7 PROTECTION

A. Covering: After completion of polishing, General Contractor to protect polished floors from subsequent construction activities with protective covering.

END OF SECTION 03 35 36
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete sealer, hardener, and slip resistant treatment

B. Concrete floor finishes.

1.2 SUBMITTALS

A. Product Data.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 "Sustainable Design Requirements".

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 "Sustainable Design Requirements".

2.2 COMPOUNDS, HARDENERS, SEALERS, AND TREATMENT MATERIALS

A. Penetrating Liquid Densifier/Sealer Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate materials and proprietary components, with a minimum solids content of 20 percent, of which not less than 50 percent is silicone; odorless; that penetrates, hardens, densifies concrete surfaces, and adds sealing protection.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Euclid Chemical Company (The); an RPM company; EUCOSIL or a comparable product by one of the following:
   a. L&M Construction Chemicals, Inc., "Seal Hard".
   b. Master Builders Solutions by BASF, "MasterKure HD 200WD".
   c. Prosoco, "Consolideck".

2.3 FINISH

A. Broom finish only at areas noted on Drawings.

PART 3 - EXECUTION

3.1 FLOOR FINISHING

A. Finish concrete floors in accordance with ACI 302 and 304.

B. Uniformly spread, screed, and float concrete. Do not use grate tampers or mesh rollers. Do not spread concrete by vibration.
C. Steel trowel surfaces, which will be left exposed.

3.2 TOLERANCES
A. Maintain surface flatness as specified in Section 03 30 00.

3.3 PROTECTING AND CURING
A. Protect exposed surfaces from premature drying.
B. Protect freshly placed concrete against wash by rain.
C. Protect concrete surface from drying for seven continuous days after placement, including weekends and holidays; alternate cycles of wetting and drying not permitted.
D. Acceptable Methods of Initial Curing (first 48 hours):
   1. Cover with fabric mats and keep wet during curing period.
   2. Maintain surface moist with fog mist applied by purpose-designed equipment.
      Note: Unless field sample proves proper curing, free from surface imperfections, can otherwise be attained, provide properly vented heated enclosure during cold weather.
E. At end of initial curing period (first 48 hours), before allowing concrete to dry, rinse and flush surface to remove reaction products.
F. Additional Acceptable Methods for Subsequent Curing (after first 48 hours):
   2. Cover with clear or white polyethylene sheets, 0.004 inch thick; lap edges minimum 4 inches and seal with tape.
   3. Seal with specified curing compound; comply with manufacturer's instructions.
   4. Where floor hardener is required, ensure compatibility prior to application of hardener over cured concrete (apply no concrete curing or hardening agents to concrete slab surfaces to receive resilient flooring).
G. Protect freshly placed concrete from all traffic, including Contractor's vehicles, until 75 percent of design strength is attained.

3.4 FLOOR HARDENER AND SEALER
A. Apply liquid chemical floor hardener and sealer on all exposed concrete floor surfaces. Apply 1 coat in accordance with manufacturer's instructions. Repeat application procedure to porous areas to assure a uniform finish.

END OF SECTION 03 35 70
SECTION 03 41 00
STRUCTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Engineering, fabrication and erection of structural precast concrete units. Work shall include, but not be limited to, the following items:

1. Precast Hollow Core Slab Sections

B. Work shall also include headers for openings, connections, anchor bolts, templates, installation instructions and grouting of precast units. Anchor bolts shall be installed by others.

C. Structural notes indicated on the drawings regarding structural precast concrete shall be considered a part of this specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.
B. Section 03 20 00 - Concrete Reinforcement.
C. Section 03 30 00 - Cast-in-Place Concrete.
D. Section 04 22 00 - Reinforced Unit Masonry.
E. Section 05 12 23 - Structural Steel.
F. Section 05 21 00 - Steel Joists.
G. Section 05 31 00 - Steel Deck.

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
4. ASTM A416 - Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete.
5. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
12. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
17. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
18. AWS D1.8 - Structural Welding Code - Seismic Supplement.
20. PCI MNL-116 - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.
22. PCI MNL-123 - Connections Manual - Design and Typical Details of Connections for Precast and Prestressed Concrete.

1.4 TESTING AND INSPECTION

A. Special Inspection and Testing:

1. In accordance with Chapter 17 of the International Building Code, the Owner shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704.0.

2. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.

3. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.

4. Duties of the Special Inspection Agency:

   a. Perform all testing and inspection required per approved testing and inspection program.

   b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.

   c. Submit a final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency’s knowledge in conformance with the approved plans and specifications.
5. Structural Component Testing and Inspection Schedule for Section 03 41 00 is as follows:

<table>
<thead>
<tr>
<th>Structural Precast Concrete</th>
<th>Continuous</th>
<th>Periodic</th>
<th>Referenced Standard</th>
<th>IBC Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection of reinforcing steel, including prestressing tendons, and placement.</td>
<td>X</td>
<td></td>
<td>ACI 318 Ch. 20, 25.2, 25.3, 26.6.1-26.6.3</td>
<td></td>
</tr>
<tr>
<td>Inspect anchors cast in concrete.</td>
<td>X</td>
<td></td>
<td>ACI 318: 17.8.2</td>
<td></td>
</tr>
<tr>
<td>Inspect anchors post-installed in hardened concrete members.</td>
<td></td>
<td></td>
<td>ACI 318: 17.8.2.4</td>
<td></td>
</tr>
<tr>
<td>Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads.</td>
<td>X</td>
<td></td>
<td>ACI 318: 17.8.2</td>
<td></td>
</tr>
<tr>
<td>Mechanical anchors and adhesive anchors not defined in row above.</td>
<td>X</td>
<td></td>
<td>ACI 318: 17.8.2</td>
<td></td>
</tr>
<tr>
<td>Verify use of required design mix.</td>
<td>X</td>
<td></td>
<td>ACI 318: Ch. 19, 26.4.3, 26.4.4</td>
<td>1904.1, 1904.2</td>
</tr>
<tr>
<td>Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.</td>
<td>X</td>
<td></td>
<td>ASTM C172, ASTM C31, ACI 318: 26.4, 26.12</td>
<td></td>
</tr>
<tr>
<td>A. Inspection of concrete placement for proper application techniques.</td>
<td>X</td>
<td></td>
<td>ACI 318: 26.5</td>
<td></td>
</tr>
<tr>
<td>B. Verify maintenance of specified curing temperature and techniques.</td>
<td>X</td>
<td></td>
<td>ACI 318: 26.5.3-26.5.5</td>
<td></td>
</tr>
<tr>
<td>Inspection of prestressed concrete:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Application of prestressing forces</td>
<td>X</td>
<td></td>
<td>ACI 318: 26.10</td>
<td></td>
</tr>
<tr>
<td>B. Grouting of bonded prestressing tendons.</td>
<td>X</td>
<td></td>
<td>ACI 318: 26.10</td>
<td></td>
</tr>
<tr>
<td>Inspect erection of precast concrete members.</td>
<td>X</td>
<td></td>
<td>ACI 318: Ch. 26.9</td>
<td></td>
</tr>
<tr>
<td>Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of forms.</td>
<td>X</td>
<td></td>
<td>ACI 318: 26.11.2</td>
<td></td>
</tr>
<tr>
<td>Inspect formwork for shape, location, and dimensions of the concrete member being formed.</td>
<td>X</td>
<td></td>
<td>ACI 318: 26.11.1.2(b)</td>
<td></td>
</tr>
</tbody>
</table>
1.5 QUALITY ASSURANCE

A. Fabrication, Erection and Welding:
   1. Fabricate and perform testing of precast units in accordance with PCI MNL-116 and PCI MNL-117.
   2. Precast concrete manufacturer shall not have less than five (5) years of continuous experience in the manufacture of precast concrete units.
   3. The precast concrete manufacturer shall have production capacity to produce required units without causing delay in work.
   4. Welding: All welding of structural steel shall be performed by operators who have been qualified within the past year as prescribed in “Qualification Procedures” of the American Welding Society (AWS).

B. Design:
   1. Precast units and their connections shall be designed by a licensed, qualified Professional engineer licensed in the state were the project is located, to withstand the loadings and criteria indicated on the drawings and contained within this section. Engineer to have not less than three (3) years of continuous experience in design work of similar scope to that shown on the drawings.

1.6 SUBMITTALS

A. Shop Drawings:
   1. Prepare and submit complete erection and detailed shop drawings for Engineer’s approval, including but not limited to the following:
      a. Member piece marks and completely dimensioned size, shape and type of each member.
      b. Plans and/or elevations locating and defining all products furnished by the manufacturer. Indicate separate face and backup mix locations plus thicknesses and indicate the limits of each finish.
      c. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
      d. Sections and details showing connections, cast-in items and their relation to the structure.
      e. Methods of connecting, anchoring, fastening, bracing and attaching work of other trades.
      f. Indicate welded connections by AWS standard symbols.
      g. Indicate size and location of openings, either saw-cut or formed, to be coordinated with other trades.
      h. Joints and openings in units and between units and the structure.
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i. Description of all loose, cast-in and field hardware.

j. Headers required for openings.

2. Manufacturer shall submit the shop drawings showing floor member and roof member layout to the Mechanical Contractor for review of openings and inserts required by mechanical components.

B. Product Data:

1. Products: Prepare and submit product data for Engineer’s approval for shop applied primers, fasteners, grout and other miscellaneous materials.

2. Concrete Design Mixes: Provide mix design for each type of concrete used.

C. LEED Submittals:

1. LEED Certification: Submit manufacturer’s certification for each concrete product including the following:
   a. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer’s name, product cost and location of extraction or harvest of raw materials.

D. Qualification Data:

1. When requested by the Architect, provide lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Design Calculations:

1. Prepare and submit one complete set of signed and sealed structural calculations to the Owner for approval of each unique and distinct precast member and precast connection prepared and certified by a Professional Engineer licensed in the state where the project is located. Owner’s approval or acceptance of the manufacturer’s design calculations shall in no way relieve the manufacturer of the full responsibility for the correctness of the calculations or the structural performance of the completed members or sections.

F. Production Drawings:

1. Be prepared to submit, upon the Owner’s request, production drawings indicating the following:
   a. Elevation view of each member.
   b. Sections and details to indicate quantities, type and position of reinforcing steel, anchors, inserts, etc.
   c. Dimensions and finishes.
   d. Prestress for strand and concrete strengths.
   e. Methods for storage and transportation.

G. Test Reports:

1. Be prepared to submit, upon the Owner’s request, test reports showing compliance with the testing provisions contained in PCI MNL-116 and PCI MNL-117.
H. Certifications:

1. Submit manufacturer’s certifications that the precast units have been fabricated to meet the fire ratings specified by the Architect.

2. Submit copies of welding procedures and personnel.

3. Submit material certificates indicating that each manufacturer is in compliance with requirements for admixture, concrete materials, reinforcing materials, bearing pads, and water absorption tests.

1.7 DELIVERY, STORAGE AND HANDLING

A. Precast units shall be transported, stored and erected in a manner that will avoid any damage or deformation. Precast units shall be lifted and supported during manufacturing, stock-piling, transporting and erection operations only at the lifting and/or supporting points shown on the approved shop drawings.

B. Store units at the project site in such a manner to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Protect edges of precast units from chipping or spalling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Materials:

1. Refer to Section 03 30 00, Cast-in-Place Concrete, for additional information and requirements for concrete, formwork, materials application, admixtures, accessories, etc.

2. Portland Cement: ASTM C150, Type I or III, gray and white.
   a. Standard gray Portland cement may be used for non-exposed backup concrete.

3. Normal-Weight Aggregates: ASTM C33
   a. Face-Mix Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining.
   b. Face-Mix Fine Aggregates: Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by Architect.

4. Admixtures – As determined by precast manufacturer, but conforming to:
   c. Fly Ash: ASTM C618, Class C or F.
   e. Coloring Admixture: ASTM C979.
5. Water – Potable and free from foreign materials in amounts harmful to concrete and embedded steel.

B. Reinforcement and Prestressing Strands:
1. Refer to Section 03 20 00, Concrete Reinforcement, for additional information and requirements for fabrication, installation, etc.
2. Reinforcing Bars - ASTM A615, Grade 60, deformed.
3. Prestressing Strand - ASTM A416, Grade 250 or 270, uncoated, seven-wire, low-relaxation strand.

C. Anchors, Inserts and Connection Material:
1. Steel Plates and Shapes - ASTM A36.
3. Deformed Bar Anchors - ASTM A496.
4. Steel Headed Studs - AWS D1.1, Type B.
5. High-Strength Bolts - ASTM F3125, Grade A325.

D. Grout:
1. Cement Grout - Portland cement, ASTM C150, Type I, and clean, natural sand, ASTM C144. Mix at a ratio of 1.0 part cement to 2.5 parts sand, by volume, with minimum water required for placement and hydration. Minimum compressive strength to be 3000 psi.
2. Non-metallic, non-shrink grout - Grout shall be a pre-mixed, non-metallic, non-corrosive, non-staining product, containing selected silica sand, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, and complying with ASTM C1107. Minimum compressive strength to be 7,000 psi at 28 days.

E. Bearing Pads: Manufacturer to choose one of the following.
1. Elastomeric Pads: AASHTO M251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer, minimum tensile strength 2250 psi per ASTM D412.
4. Hardboard: AHA A135.4, Class 1, tempered hardboard strips, smooth on both sides.
2.2 CONCRETE MIXES

A. Concrete shall achieve a minimum 28-day compressive strength of 5000 psi.

B. Prestressed concrete shall achieve a minimum release strength of 3500 psi.

2.3 FABRICATION AND MANUFACTURE

A. Fabricate precast member in plastic lined or metal forms which are true to line and plane. Form openings of 100 square inches in area.

1. Edge and Corner Treatment: Uniformly chamfered.

B. General Contractor shall identify opening locations to precast manufacturer for coordination and shall provide precaster with cast-in items required by other trades.


D. Precast hollow core slabs shall have end bearings lengths as indicated on the structural drawings, but at least 3 inches minimum.

E. Clean reinforcement of loose rust, mill scale, and other materials, which may reduce or destroy bond with concrete.

F. Place reinforcement to obtain at least the minimum coverage for concrete protection as specified by ACI-318. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

G. Install welded wire reinforcement in longest lengths practical. Lap adjoining pieces one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

H. Cast in structural inserts, plates and accessories as indicated on the drawings and as determined by the fabricator for erection and anchorage.

I. Provide cast-in-place or structural steel headers for openings larger than one slab width according to fabricator’s written recommendations.

J. Finishes, unless otherwise indicated on the drawings, provide:

1. Precast hollow core slabs:

   a. Standard underside - As resulting from casting against approved forms. Small surface holes, normal color variations, normal joint marks, minor chips and spalls will be tolerated. Major imperfections, honeycombs, structural defects, or other defects will not be tolerated.

   b. Standard topside - As resulting from vibrating screed and additional hand finishing at projections. Normal color variations, normal joint marks, minor chips and spalls will be tolerated. Major imperfections, honeycombs, structural defects, or defects which would affect finished floor materials will not be tolerated.
c. **Topside Finish for Composite Construction** - Broom or rake top finish of precast concrete units for bonding with concrete floor topping.

d. **Exposed ends** - Strands shall be recessed a minimum of ½ in., the holes filled with grout and rubbed flush.

2. **Special Finishes:**

   a. **Commercial Finish** - Remove fins and large protrusions and fill large holes. Rub or grind ragged edges. Faces are to be true, well-defined surfaces.

K. Provide permanent markings to identify pick-up points and orientation in structure, complying with the markings indicated on approved shop drawings. Imprint date of casting on each precast unit on a surface, which will not show in the structure.

L. Weight of hollow core precast units shall not exceed the following:

1. 10" hollow-core: 76 psf.

### 2.4 LEED CREDIT

A. LEED Credit MRc 4.1/4.2 – Precast wall panels, hollowcore, double tees, columns, and beams shall have a maximum recycled content for standard products.

B. LEED Credit MRc 5.1/5.2 – Precast shall be manufactured within 500 miles of project site. Aggregate, sand, water, and reinforcing shall be procured within 500 miles of project site.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine areas and conditions under which Work is to be performed and notify the General Contractor in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Do not install precast concrete units until supporting concrete has attained 75% of its design compressive strength.

#### 3.2 ERECTION

A. The General Contractor shall be responsible for:

1. Providing suitable access to the site, proper drainage, and firm, level bearing for the hauling and erection equipment to operate under their own power.

2. At time of delivery, provide area inside and outside the building to allow adequate maneuverability for erection procedures.

3. Placement and accurate alignment of anchor bolts, plates or dowels in footings or foundation walls, ledge angles and other field placed support units.

4. Provide all shoring and bracing required by manufacturer’s recommendations and as indicated on the precast shop drawings.
B. Install bearing pads on true, level and uniform bearing surfaces. Maintain the correct position of the pads until precast units are in place.

C. Locate lifting hooks as specified on the shop drawings.

D. Erect units in compliance with PCI MNL-127.

E. After precast units are in place, remove lifting hooks and handling inserts, level bottom of slab to correct for unequal camber prior to grouting and perform necessary welding in accordance with AWS D1.1.

F. Shore and brace precast units to maintain location, stability and alignment until permanent connections are established.

G. Precast units shall be properly aligned and leveled as required by the shop drawings.

H. Remove hoisting or shoring devices and fill voids with sand-cement grout to be flush to adjacent surfaces.

I. Repair damaged metal surfaces by cleaning and applying a coat of galvanizing repair paint to galvanized surfaces or repainting damaged surfaces. Damage to those surfaces having special finishes as specified, shall be brought to the attention of the Architect.

J. Required openings less than 100 square inches in area in precast units shall be field cut. No openings shall be cut so as to pass through the leg sections of the prestressed units. Holes cut in slabs not concealed by finished ceiling systems shall be cut through, starting on underside with hand or mechanical chisels or from top only with core type drills. Restrict openings to as small as possible.

K. Use flowable cement grout (minimum compressive strength 3,000 psi) to grout keyways between hollow core slabs as follows:

1. Clean and prepare keyways to be filled. Joints should be free of debris and dust.
2. Seal underside of slab joints to prevent grout leakage.
3. Fill grout keys full and strike flush with top surface.
4. Remove grout that seeps through to ceiling below before grout hardens.

L. Use non-metallic, non-shrink grout (minimum compressive strength 7,000 psi at columns where required by the precast manufacturer's shop drawings. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout until all voids are filled and flush with adjacent surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Grouting shall follow closely behind the erection of precast wall panels and columns.

M. Welding: Comply with AWS D1.1 and AWS D1.4

1. Protect precast concrete units and bearing pads from damage by field welding or cutting, and provide noncombustible shields as required.

N. Installation and caulking of the precast units shall be supplied by the precast manufacturer.
O. Field Touchup:

1. Immediately after erection, field welding and/or final bolting, clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt and stains.

3.3 FIELD QUALITY CONTROL

A. The contractor may choose to employ a separate testing laboratory to evaluate the precast manufacturer’s quality control and testing methods. If requested, the precast manufacturer shall allow the Owner’s testing company access to the manufacturing facility, and provide samples of material for additional evaluation.

B. Precast units which do not conform to specified requirements, including strength, tolerances, and finishes, or which are damaged during handling and erection, shall be replaced with precast concrete units that meet the requirements of this specification.

C. The contractor shall be responsible for the cost of corrections to other work affected by or resulting from corrections to precast concrete work.

D. Precast units having dimensions greater than required will be rejected if appearance or function of the structure is adversely affected, or if larger dimensions interfere with other construction. The contractor shall be responsible for the cost of necessary repair, removal and replacement of rejected units.

E. The precast supplier shall inspect all field cutting, which cuts reinforcing. The precast manufacturer shall issue a letter to the Owner either accepting the system as modified or directing corrective procedures to offset cut reinforcing. The contractor shall be responsible for the cost of any corrective procedures.

F. Clean all exposed surfaces after erection to remove weld marks, other markings, stains and dirt. Wash and rinse according to manufacturer’s recommendations. Protect other work from damage or staining during cleaning operations.

END OF SECTION 03 41 00
SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Concrete masonry units (CMUs).
   2. Face brick.
   3. Mortar and grout.
   4. Ties and anchors.
   5. Embedded flashing.
   6. Miscellaneous masonry accessories.
   7. Reinforcing steel.
   8. Masonry joint reinforcement.

B. See Division 01 Section “Special Inspections and Tests” for required verifications and inspections per Chapter 17 of the International Building Code.

C. Section 01 81 13.14 “Sustainable Design Requirements”.

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

E. See Division 07 Section "Sheet Metal Flashing and Trim" for furnishing manufactured reglets installed in masonry joints for metal flashing.

1.2 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.

B. Samples for Initial Selection:
   1. Submit flat panel or strap samples of brick for verification and approval of finish, texture, and color variation. **Note to contractor: the specified brick has a longer lead time; it is suggested to confirm the lead time and to plan accordingly. Schedule delays because of delayed ordering are solely the responsibility of the contractor.**
   2. Colored mortar samples showing the full range of colors available.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
   1. Mortar complying with property requirements of ASTM C 270.
   2. Concrete Masonry Units as required under Field Quality Control.

D. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

E. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, “Details and Detailing of Concrete Reinforcement”. Include material, grade, bar schedules, tie and/or stirrup spacing, splices, bent bar diagrams, and other arrangements and assemblies required for fabrication and placement of reinforcement for masonry work. Show all walls in plan and elevation.
1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 "Sustainable Design Requirements".

1.4 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

C. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner.
   1. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
   2. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
   3. Mortar Test (Property Specification): For each mix required, per ASTM C 780.
   4. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.

D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

E. Installer qualifications: An experienced masonry contractor (company or corporation) that has been in business for not less than 10 years and has completed masonry work similar in materials, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance. The masonry company shall also be required to commit a foreman or mason in charge of overseeing and directing the daily construction activities in the field who is an experienced mason with not less than 15 years of experience as a masonry installer and has overseen masonry work similar in materials, design, and extent to that indicated for this Project. Masonry contractor may be required to submit references of past projects within the last 10 years of similar scope to the Project. Or - Installer qualifications: An experienced masonry contractor (company or corporation) that has been in business for not less than 10 years or has completed masonry work similar in materials, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance. The masonry company shall also be required to commit a foreman or mason in charge of overseeing and directing the daily construction activities in the field who is an experienced mason with not less than 15 years of experience as a masonry installer and has overseen masonry work similar in materials, design, and extent to that indicated for this Project. At the Owner's Request, Masonry Contractor may be required to submit a complete list of projects with reference contact information completed within the last 10 years of similar scope to the Project.
1.5 **MOCKUPS**

A. Exterior wall mockup: Before installing unit masonry, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups for each type of brick masonry in sizes approximately 48-inches long by 48-inches high by full thickness, including CMU backup wall, air/moisture barrier, flexible flashing membrane, stainless steel drip plate and other associated cavity drainage accessories.
2. Include a full, vertical sealant-filled joint for review of workmanship and color. Sealant color to be determined by Architect from manufacturer's full range.
3. Clean exposed faces of mockups with approved masonry cleaner.

B. Interior burnished CMU wall mockup: Before installing unit masonry, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups for each type of burnished CMU masonry in sizes approximately 48-inches long by 48-inches high by full thickness.
2. Include a full, vertical sealant-filled joint for review of workmanship and color. Sealant color to be determined by Architect from manufacturer's full range.
3. Clean exposed faces of mockups with approved masonry cleaner.

C. General
1. Locate mockups in the locations as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
5. 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; wall assembly construction.
6. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
7. 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.
8. Demolish and remove mockups after exterior building walls have been finished and approved by Architect.

1.6 **DELIVERY, STORAGE, AND HANDLING**

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. 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 coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 RECYCLED CONTENT

A. Products specified in this section contribute to the project-wide requirements for Recycled Content described in Section 0 81 13.14 “Sustainable Design Requirements”.

2.3 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Products: Subject to compliance with requirements, provide one of the products specified.

2.4 CONCRETE MASONRY UNITS (CMU)

A. Shapes: Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions as indicated on drawings. For interior block work, provide bull-nosed corner blocks at exposed corners, except where ceramic tiles being installed. See plans for locations.

B. Integral Water Repellent: At exterior applications, or as noted on drawings, provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength for decorative concrete masonry units (burnished block).

1. Products:
   a. Addiment Incorporated; Block Plus W-10.
   b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.
   c. Master Builders, Inc.; MasterPel.

C. Concrete Masonry Units: ASTM C 90

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi for interior non-load bearing walls. Refer to structural drawings for exterior masonry walls and structural wall strength requirements.

2. Weight Classification: Normal weight, Grade N.

3. Provide Type I, moisture-controlled units.

4. Pattern and Texture for Standard Units:
   a. Running bond pattern unless noted otherwise.
   b. Tool all joints concave.

5. All exposed unit masonry: Free of chips, cracks, and other imperfections.

6. Provide burnished CMU at interior walls as noted on Drawings.
   a. Basis of Design burnished CMU product: Ultra Burnished Masonry Unit as manufactured by Premier Block Corporation.
   b. Sizes: Match standard CMU.
   c. Bond pattern: Match standard CMU.
   d. Exposed corners: Bullnose.
   e. Colors:
      1) Burnished CMU Type 1: Light Frost (10-218C).
   f. Mortar: provide colored mortar; color to be determined by Architect from manufacturer’s full range.

2.5 FACE BRICK VENEER

A. General: Provide shapes indicated and as follows:

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 shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick Veneer: ASTM C 216, Grade SW, Type FBX.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3,000 psi.

2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
3. **Efflorescence:** Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."

4. **Application:** Use where brick is exposed and where noted on the drawings, unless otherwise indicated, and to match bond/pattern of existing building.

5. **Surface Coating:** Brick with colors or textures produced by application of coatings to withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 15 feet.

6. **Size(s)**
   a. Provide modular size units.
   b. **Actual Dimensions:** 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

7. **Bond pattern(s)**
   a. Install face brick veneer in running bond pattern unless indicated otherwise.

8. **Products**
   a. **Manufacturer:** Endicott Clay Products
   b. **Types:**
      1) Face Brick Veneer Type 1 (field brick): Manganese Ironspot Smooth.
      2) Face Brick Veneer Type 2 (accent brick): Manganese Ironspot Vertical Score.
   c. **Note to contractor:** the above listed brick has a longer lead time; it is suggested to confirm the lead time and to plan accordingly. Schedule delays because of delayed ordering are solely the responsibility of the contractor.

### 2.6 MASONRY LINTELS

A. **General:** Provide masonry lintels complying with requirements below.

B. **Masonry Lintels:** Made from bond beam concrete masonry units shaped with square corner void to permit placement of two reinforcing bars in the same plane within three inches from the bottom of the unit and filled with coarse grout.

1. Provide all bond beam lintels of a construction and overall aesthetic to match project standard CMU construction, including finished face of units and joint tooling.

### 2.7 MORTAR AND GROUT MATERIALS

A. **Preblended mortar mix:**
   1. **Basis of Design:** Spec Mix Precluded Mortar Mix.
   2. **Compressive Strength:** 1800 psi at 28 days.
   3. **Substitutions allowed in accordance with section 00 26 00.**
      a. ASTM C 270, for either proportion or property specification.
      b. 2010 CBC Sections 2103.8 and 2103A.8.
      c. **Color:** 94H Iron Black as manufactured by Solomon Colors.

B. **Site-blended mortar mix consisting of, but not limited to, the following:**
   1. **Portland Cement:** ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.
   2. **Hydrated Lime:** ASTM C 207, Type S and Type N
   3. **Aggregate for Mortar:** ASTM C 144.
      a. For joints less than 1/4-inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
      b. **Colored-Mortar Aggregates:** Natural sand or crushed stone of color necessary to produce required mortar color.
   4. **Aggregate for Grout:** ASTM C 404.


7. Products:
   a. Addiment Incorporated; Mortar Kick.
   b. Euclid Chemical Company (The); Accelguard 80.
   d. Sonneborn, Div. of ChemRex; Trimix-NCA.

8. Water: Potable

9. Retain first paragraph and subparagraphs below if integral water repellent is used in concrete masonry units.

C. Mortar Pigments and Admixtures, Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

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

2. Do not use calcium chloride in mortar or grout.

3. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

4. Colored Portland Cement-Lime Mix: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar:
   a. Mortar pigment and colored mortar: Comply with ASTM C979.

5. Cold-Weather Admixture (if required):
   a. Accelguard 80; Euclid Chemical Co.
   c. Trimix-NCA; Sonneborn, Div. of ChemRex, Inc.

D. Grout
   1. Compressive Strength: 2,000 psi at 28 days.
   2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

2.8 REINFORCEMENT AND TIES

A. Uncoated Steel Reinforcing Bars: ASTM A 615, Grade 60.

B. Weldable Steel Reinforcing Bars: ASTM A706, Grade 60.

C. Masonry Joint Reinforcement and Ties: ASTM A 951; hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
   1. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
   2. Wire Size for Cross Rods: 9-gauge W1.7 or 0.148-inch diameter.
   3. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches on center Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
   5. Multiwythe Masonry:
      a. Adjustable (two-piece) type, with one side rod at each face shell of backing wythe and with ties that extend into facing wythe. Ties engage eyes or slots in reinforcement and extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
2.9 ADJUSTABLE MASONRY-VENEER ANCHORS

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
1. 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.

B. Products: Subject to compliance with requirements, provide the following:
1. Screw-Attached, Masonry-Veneer Anchors:
   a. Basis of Design:
      1) CMU backup walls: '2-Seal Thermal Concrete Wing Nut Anchor' as manufactured by Hohmann & Barnard.
      2) Metal stud backup walls: '2-Seal Thermal Wing Nut Anchor for metal stud backup wall' as manufactured by Hohmann & Barnard.
   b. Length: Contractor verify necessary thickness with anchor manufacturer.
   c. Spacing: Provide at least one anchor for each 2.67 ft² of wall surface. Install anchors at 16" on center horizontally and 24" on center maximum vertically. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around the perimeter.
   d. Install through board insulation and directly into metal stud framing. Do not over-compress board insulation more than 1/4" from face of insulation board.

2.10 FLASHING MATERIALS

A. Thru-Wall Flexible Flashing Membrane Product
1. Composite, flexible flashing: where indicated on Drawings provide a polyester scrim reinforced, 40-mil thick flexible flashing membrane.
2. Products: Subject to compliance with requirements, provide the following:
   a. Textroflash Flashing as manufactured by Hohmann & Barnard.
   b. Install per manufacturer's recommendations. Flexible flashing membrane to extend up vertical face of backup wall a minimum of 12-inches.

B. Termination Bar
1. Provide continuous termination bar at top of all flexible flashing membrane to secure to wall and to prevent sagging.
2. Products: Subject to compliance with requirements, provide the following:
   a. T2 - Stainless-steel Termination Bar as manufactured by Hohmann & Barnard
   3. Install polyether sealant behind and on top of termination bar.

C. Stainless-steel drip plate
1. Provide continuous stainless-steel drip plate in masonry bed joint at location(s) shown on Drawings. Extend through masonry joint and project out the face of the wall as indicated on the Drawings.
2. Products: Subject to compliance with requirements, provide the following:
   a. Drip Plate 'DP' as manufactured by Hohmann & Barnard.
   b. Width: 3".
   c. Material: Stainless-steel type 304.
   d. Provide preformed inside and outside corners at all inside and outside wall corners.
   3. Do not solder stainless-steel drip plate joints. Lap joints 1/2" and seal together with polyether sealant.
4. Do not run stainless-steel drip plates continuous through vertical control joints. Lap stainless-steel drip plates 1/2" at all vertical control joints where control joints occur at stainless-steel drip plate and sealed together with polyether sealant.

D. Stainless-steel Corners and End Dams
   1. Provide soldered stainless-steel inside corners, outside corners and end dams in conjunction with flexible flashing membrane
   2. Locations:
      a. Inside corners at face brick veneer walls.
      b. Outside corners at face brick veneer walls.
      c. End Dams: flashing terminations including, but not limited to end of walls and window/door jambs.
   3. Products: Subject to compliance with requirements, provide the following:
      a. Soldered stainless-steel inside corners, outside corners and end dams as manufactured by Hohmann & Barnard.
      b. Material: 26-gauge, stainless-steel type 304.

E. Head Joint Vent: Quadro-Vent as manufactured by Hohmann & Barnard, Inc. Color to be selected by Architect. Size appropriately to fill joint void horizontally and vertically.

F. Cavity Drainage Material: Thickness to suit cavity, refer to Drawings, free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar droppings.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from urethane.

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.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.12 MASONRY CLEANERS

A. Masonry Cleaner:
   1. Detergent-based cleaner: NMD 80 as manufactured by EaCo Chem.
   2. Note to contractor: Contractor is responsible for confirming the compatibility of the masonry cleaner with the face brick veneer and colored mortar. It is suggested to test the masonry cleaner and cleaning process in a non-conspicuous area, as confirmed by the architect, to ensure masonry cleaner and process do not damage mortar.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Delete subparagraph below if not required.
B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required, 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.

B. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

C. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

D. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

E. 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.

F. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
   1. 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.
   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.

G. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen work.

3.3 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 Brick Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Bond Pattern for Concrete Masonry: Lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.4 MORTAR MIXING

A. Proportion mortar by dry volume using accurately calibrated equipment similar and equal to equipment manufactured by VOL-CON, Davenport, IA, phone (319) 383-1856; measurement by shovel not permitted. Machine mix for at least 3 minutes and not over 5 minutes with maximum amount of water to produce workable consistency.

B. Proportion admix according to manufacturer’s recommendations.

C. Do not use admixtures to lower freezing point of mortars.

D. Use mortar within 2-1/2 hours after initial mixing. When necessary, retemper mortar within 2 hours from mixing to replace water lost by evaporation. Do not use mortar or grout after it has begun to set.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and concrete masonry units 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. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.6 CAVITIES

A. Keep cavities clean of mortar droppings and other materials during construction.
   1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.

3.7 CONSTRUCTION TOLERANCES

A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following, whichever is more stringent:

B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8-inch in 20-feet, nor 1/4-inch maximum.
C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/8-inch in 10-feet, nor 1/4-inch maximum.

D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/8-inch in 20-feet, nor 1/4-inch maximum.

E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8-inch, with a maximum thickness limited to 1/4-inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8-inch.

G. Head joint and bed joint transitions: Smooth and free of excess mortar. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/16-inch.

3.8 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:
      a. Where bed joints of both wythes align, use tab-type reinforcement.
      b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement.
      c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement to allow for differential movement regardless of whether bed joints align.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Coat cavity face of backup wythe to comply with Division 07 Section “Bituminous Dampproofing.”

D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches on center both ways, on inside face of insulation boards, or attach with adjustable veneer anchor, or per the manufacturer’s written installation instructions, whichever is more stringent

3.9 MASONRY JOINT REINFORCEMENT

A. General: Install 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.

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.
3.10 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
   1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated.
   2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches on center vertically and 36 inches on center horizontally.

3.11 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to masonry backup with masonry-veneer anchors to comply with manufacturer’s written installation instructions.

3.12 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
   1. Construct formwork to conform to shape, line, and dimensions shown. Make it 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 temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602:
   1. Provide horizontal and vertical reinforcement indicated on Drawings. Position reinforcement accurately at the spacing indicated.
   2. Restrain vertical reinforcement against displacement at top and bottom of cells and at intervals not exceeding 8 feet. Maintain position within ¼ inch of dimensioned position.
   3. Provide clear distance between parallel bars in close proximity of not less than the nominal bar diameter or 1”, whichever is greater.
   4. Set dowels in footings to align with cores containing reinforcing steel.
   5. Splice reinforcement as required. Provide contact, lapped splices, unless otherwise indicated. Provide clear distance between contact, lap slices, and adjacent bars or splices not less than the nominal bar diameter, or 1”, whichever is greater.
   6. Construct lintels comprised of reinforced concrete masonry with two bars within 3 inches of bottom of masonry unit. Shape masonry units to accommodate required reinforcing configuration. Extend reinforcing no less than 40 bar diameters beyond edge of spanned opening into continuous bond beam or passing through reinforced jamb cells.
   7. Horizontal reinforcement may be placed as the masonry work progresses. Lap horizontal reinforcement 6” at splices and provide prefabricated “L” and “T” sections at corners and intersections. Install horizontal joint reinforcement as follows:
      a. Interior non-load bearing walls - 24” on center vertically.
      b. Exterior walls and interior load bearing walls - 16” on center vertically.
      c. Parapet walls - 8” on center vertically unless noted otherwise.
      d. Two courses above and below openings. Extend 16” each side of opening.
      e. Continuous in first and second joint below top of walls.
   8. Lay masonry units with core cells vertically aligned clear of mortar and unobstructed.

C. Grouting and Grouted Components: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Permit mortar to cure at least 4 hours before placing grout, or minimum time required by current code, whichever is greater.
3. Place and consolidate grout fill without displacing reinforcing.
4. Fill all cells containing reinforcing in concrete blocks solid with grout. Fill all cells below grade solid with grout.
5. Wet masonry unit surfaces in contact with grout just prior to grout placement.
6. Grout spaces 2 inches or greater in width with course grout using low lift grouting techniques.
7. Low Lift Grouting: Lay CMU to maximum pour height. When grouting is stopped for more than one hour, terminate grout 1½ inches below top of upper masonry unit to form a positive key for subsequent grout placement. Place vertical reinforcement and secure prior to grouting. Extend reinforcement above elevation of maximum pour height as required for splicing.

3.13 LINTELS

A. Install steel lintels where indicated always on embedded steel anchor plates.
B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated. See structural general notes for further guidance.
C. Provide copper or stainless-steel slip sheet between lintel and bearing brick.

3.14 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.
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 as recommended by flashing manufacturer.
   2. 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.
   3. 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.
   4. 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.
C. Install head vents in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:
   1. Space head vent at 24 inches on center
D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.
3.15 CONTROL AND EXPANSION JOINTS
A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

A. Provide expansion joints in exterior brick masonry, where indicated on the drawings, not to exceed 30'-0" intervals.

B. Locate control joints in concrete unit masonry maximum 25 feet (7.5 mm) on center and back of brick expansion joints. In cavity walls offset 4" to 8" (100 to 200mm) from direct alignment with brick expansion joint.

C. Install control joint strip in continuous lengths as walls are laid. Heat Solvent weld butt and corner joints in accordance with manufacturer's instructions.

D. Keep joint gap free from mortar or debris.

E. Provide control/expansion joint at interface between Cast Stone components and Brick Assembly: Compressible Filler and Preformed Control-Joint Gasketing.

3.16 REINFORCED UNIT MASONRY INSTALLATION
A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make it 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 temporary loads that may be placed on them during construction.

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

1. Provide horizontal and vertical reinforcement indicated on Drawings. Position reinforcement accurately at the spacing indicated.

2. Restrain vertical reinforcement against displacement at top and bottom of cells and at intervals not exceeding 8 feet. Maintain position within ½ inch of dimensioned position.

3. Provide clear distance between parallel bars in close proximity of not less than the nominal bar diameter or 1", whichever is greater.

4. Set dowels in footings to align with cores containing reinforcing steel.

5. Splice reinforcement as required. Provide contact, lapped splices, unless otherwise indicated. Provide clear distance between contact, lap slices, and adjacent bars or splices not less than the nominal bar diameter, or 1", whichever is greater.

6. Construct lintels comprised of reinforced concrete masonry with two bars within 3 inches of bottom of masonry unit. Shape masonry units to accommodate required reinforcing configuration. Extend reinforcing no less than 40 bar diameters beyond edge of spanned opening into continuous bond beam or passing through reinforced jamb cells.

7. Horizontal reinforcement may be placed as the masonry work progresses. Lap horizontal reinforcement 6" at splices and provide prefabricated "L" and "T" sections at corners and intersections. Install horizontal joint reinforcement as follows:

a. Interior non-load bearing walls - 24" on center vertically.
b. Exterior walls and interior load bearing walls - 16" on center vertically.
c. Parapet walls - 8" on center vertically unless noted otherwise.
d. Two courses above and below openings. Extend 16" each side of opening.
e. Continuous in first and second joint below top of walls.

8. Lay masonry units with core cells vertically aligned clear of mortar and unobstructed.

C. Grouting and Grouted Components: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Permit mortar to cure at least 4 hours before placing grout, or minimum time required by current code, whichever is greater.
3. Place and consolidate grout fill without displacing reinforcing.
4. Fill all cells containing reinforcing in concrete blocks solid with grout. Fill all cells below grade solid with grout.
5. Wet masonry unit surfaces in contact with grout just prior to grout placement.
6. Grout spaces 2 inches or greater in width with course grout using low lift grouting techniques.
7. Low Lift Grouting: Lay CMU to maximum pour height. When grouting is stopped for more than one hour, terminate grout 1½ inches below top of upper masonry unit to form a positive key for subsequent grout placement. Place vertical reinforcement and secure prior to grouting. Extend reinforcement above elevation of maximum pour height as required for splicing.

3.17 FIELD QUALITY CONTROL

A. Owner will engage a qualified, independent testing and inspection agency to sample materials, perform tests, and submit test reports.

B. Contractor: Notify testing and inspection agency one week prior to start of masonry construction.

C. Sample and test masonry for quality control as follows:
1. Verification of \( f'_{m} \) by unit strength method:
   a. Concrete masonry units: Manufacturer to submit test reports from qualified testing agency indicating compliance with ASTM C90 requirements for compressive strength, absorption properties, moisture content, weight, and dimensions for each class of unit supplied.
   b. Mortar: Test mortar once every 5,000 square feet of wall area for compressive strength in accordance with ASTM C780.
   c. Grout: Test grout once every 5,000 square feet of wall area for compressive strength and slump in accordance with ASTM C1019.
2. Refer to Section 01 45 00 “Special Inspections and Tests” for required verifications and inspections.

3.18 REPAIRING, POINTING, CLEANING and SEALING

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 vents, 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.
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.
   3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
   5. Clean masonry with a specified cleaner applied according to manufacturer’s written instructions.
   6. Following cleaning and preparation procedures, apply water repellent weatherproofing materials in accordance with manufacturer’s instructions.

3.19 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 “Earth Moving.”
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00
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PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Cast stone masonry.
   2. Cast stone masonry accessories.

1.2 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Product Data: Include dimensions of individual components.

C. 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. Title Block
      a. Project name and location
      b. Name and address of manufacturer
      c. Contractor name
      d. Architect name
      e. Job number
      f. Sheet number
      g. Submittal number or other unique identifier, including revisions

   2. Layout sheets
      a. Key plans
      b. Floor plans (as appropriate)
      c. Elevations (as appropriate)
      d. Arrangement of joints (optional for standard or semi-custom installations)
      e. Annotation of stone types (piece marks) and their locations

   3. Detail sheets
      a. Piece profiles
      b. Cross-sections
      c. Reinforcement
      d. Exposed faces
      e. Anchoring methods
      f. Anchors

D. Samples: Submit four (4) 6-inch x 6-inch samples of cast stone for each color and texture of cast stone proposed to be furnished for the project.

E. Manufacturer Qualification Data
   1. Manufacturer must be an active member (in good standings) of the Cast Stone Institute®
   2. Manufacturer must follow EPA (Environmental Protection Agency) and DNR (Department of Natural Resources) regulations regarding:
      a. Permits
      b. Storm water runoff
      c. Waste water management
      d. Air emission control
3. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of Cast Stone required in accordance with the project schedule.
4. Manufacturer shall have minimum of (10) years of experience manufacturing Cast Stone.
5. Manufacturer shall submit a written list of projects similar in scope and at least three (3) years of age, architect and contractor references.
6. All products must contain Portland cement.

F. Material Test Reports
1. Submit manufacturers test results of Cast Stone previously made by the manufacturer in the last 90 days, for the following:
   a. Compressive Strength
   b. Absorption
   c. Air Content (wet cast)

G. Delegated Design
1. Cast stone reinforcing and tie-backs shall be fully engineered by the manufacturer, or manufacturer’s third-party engineering representative, including specified design loads and anchorage for cast stone reinforcing and tie-backs.
2. Delegated design submittal shall include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation. If structural analysis is required, these must be signed/sealed by a licensed Iowa PE.

1.3 DEFINITIONS
A. Cast Stone - a refined architectural concrete building unit manufactured to simulate natural cut stone, used in unit masonry applications.
1. Dry Cast Concrete Products – manufactured from zero slump concrete.
   a. Vibrant Dry Tamp (VDT) casting method: Vibratory ramming of earth moist, zero-slump concrete against a rigid mold until it is densely compacted.
   b. Machine casting method: manufactured from earth moist, zero-slump concrete compacted by machinery using vibration and pressure against a mold until it becomes densely consolidated.
2. Wet Cast Concrete Products – manufactured from measurable slump concrete.
   a. Wet casting method: manufactured from measurable slump concrete and vibrated into a mold until it becomes densely consolidated.

1.4 QUALITY ASSURANCE
A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, with sufficient production capacity to manufacture required units.
1. Manufacturer is a producing member of the Cast Stone Institute.

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:
2. Substitutions: allowed in accordance with Section 00 26 00.
2.2 CAST STONE UNITS

A. Provide cast stone units complying with ASTM C 1364 using the vibrant dry tamp or wet-cast method.
1. Provide units resistant to freezing and thawing.
2. Slope exposed horizontal surfaces 1:12, unless otherwise indicated.
3. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
4. Provide drips on projecting elements, unless otherwise indicated.
5. Physical properties:
   a. Compressive Strength - ASTM C 1194: 6,500 psi (45 MPa) minimum for products at 28 days.
   b. Absorption - ASTM C 1195: 6% maximum by the cold-water method, or 10% maximum by the boiling method for products at 28 days.
   c. Air Content – ASTM C173 or C 231, for wet cast product shall be 4-8% for units exposed to freeze-thaw environments. Air entrainment is not required for VDT products.
   d. Freeze-thaw – ASTM C 1364: The CPWL shall be less than 5% after 300 cycles of freezing and thawing.
   e. Linear Shrinkage – ASTM C 426: Shrinkage shall not exceed 0.065%.
6. Production materials:
   a. Portland cement – Type I or Type III, white and/or grey, ASTM C 150.
   b. Coarse aggregates - Granite, quartz or limestone, ASTM C 33, except for gradation, optional for the VDT casting method.
   c. Fine aggregates - Manufactured or natural sands, ASTM C 33, except for gradation.
   d. Colors - Inorganic iron oxide pigments, ASTM C 979; carbon black pigments not allowed.
   e. Admixtures- Comply with the following:
      1) ASTM C 260 for air-entraining admixtures.
      2) ASTM C 494/C 495M Types A - G for water reducing, retarding, accelerating and high range admixtures.
      3) Other admixtures: integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or laboratory testing.
      4) ASTM C 618 mineral admixtures of dark and variable colors not allowed in surfaces intended to be exposed to view.
      5) ASTM C 989 granulated blast furnace slag allowed to improve physical properties. Tests are required to verify these features.
   f. Water – Potable
      1) Reinforcing bars:
         a) ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 in. (37 mm).
         b) Welded Wire Fabric: ASTM A 185 where applicable for wet cast units.
      2) All anchors, dowels and other anchoring devices and shims: Standard building stone anchors commercially available in non-corrosive material such as zinc plated, galvanized steel, brass, or stainless-steel Type 302 or 304.

B. Cure units by one of following methods:
1. Cure units with steam in enclosed curing room at temperature of 105 deg F or above and 95 to 100 percent relative humidity for 6 hours.
2. Cure units with dense fog and water spray in enclosed warm curing room at 95 to 100 percent relative humidity for 24 hours.

3. Cure units to comply with one of the following:
   a. Not less than 5 days at mean daily temperature of 70 deg F or above.
   b. Not less than 6 days at mean daily temperature of 60 deg F or above.
   c. Not less than 7 days at mean daily temperature of 50 deg F or above.
   d. Not less than 8 days at mean daily temperature of 45 deg F or above.

C. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

D. Colors and Finish:
   2. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 in. (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 in.2 (25 mm2) and not obvious under direct daylight illumination at a 5 ft (1.5m) distance.
   3. All exposed edges to be hand tooled to ensure a consistent quality edge.
   4. Units shall exhibit a texture equal to the approved sample when viewed under direct daylight illumination at a 10 ft (3 m) distance.
      a. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
      1) Total color difference – not greater than 6 units.
      2) Total hue difference – not greater than 2 units.

5. All Cast Stone shall be hand sanded and acid washed with a 10% muriatic acid solution.
6. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a distance of 8-feet.

2.3 REINFORCING

A. Reinforce the units as required by the drawings and for safe handling and structural stress.

B. Minimum reinforcing shall be 0.25 percent of the cross-section area.

C. Reinforcement shall be noncorrosive where faces exposed to weather are covered with less than 1.5 in. (38 mm) of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.

D. Panels, soffits and similar stones greater than 24 in. (600 mm) in one direction shall be reinforced in that direction. Units less than 24 in. (600 mm) in both their length and width dimension shall be non-reinforced unless otherwise specified.

E. Welded wire fabric reinforcing shall not be used in dry cast products.

2.4 CURING

A. Cure units in a warm curing chamber approximately 100ºF (37.8ºC) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70ºF (21.1ºC) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350 degree-days (i.e. 7 days @ 50ºF (10ºC) or 5 days @ 70ºF (21ºC)) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.
2.5 MANUFACTURING TOLERANCES

A. Cross section dimensions shall not deviate by more than ±1/8 in. (3 mm) from approved dimensions.

B. Length of units shall not deviate by more than length/360 or ±1/8 in. (3 mm), whichever is greater, not to exceed ±1/4 in. (6 mm).
   1. Maximum length of any unit shall not exceed 12 times the average thickness of such unit unless otherwise agreed by the manufacturer.

C. Warp, bow, or twist of units shall not exceed length/360 or ±1/8 in. (3 mm), whichever is greater.

D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features – On formed sides of unit, 1/8 in. (3 mm), on unformed sides of unit, 3/8 in. (9 mm) maximum deviation.

2.6 PRODUCTION QUALITY CONTROL

A. Testing.
   1. Test compressive strength and absorption from specimens selected at random from plant production.
   2. Samples shall be taken and tested from every 500 (14 m³) cubic feet of product produced.
   3. Perform tests in accordance ASTM C 1194 and C 1195.
   4. New and existing mix designs shall be tested for strength, absorption and Freeze Thaw compliance prior to producing units.

2.7 ACCESSORIES

A. Anchors and Dowels:
   1. Material(s): Type 304 stainless steel.
   2. Types and Profiles:
      a. Provide pre-bent or field-bent strap anchors at top and bottom of cast stone pieces, where designated by delegated design review.
      b. Strap anchors shall be designed to attached to backup wall structure.
      c. Strap anchors shall be of a thickness to comply with design loads, as designated by delegated design review.
      d. Provide associated fasteners, including nailon pins, concrete fasteners, metal stud fasteners, wood fasteners, bolts, etc, in size and strength designated by delegated design review.
   3. Anchors, dowels and fasteners to be furnished by cast stone supplier; or by subcontractor or supplier if approved by manufacturer.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner complying with requirements in Division 04 Section "Unit Masonry" and approved for intended use by cast stone manufacturer and approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

C. Weeps:
2. Locations: Provide at base of cast stone veneer panels at thru-wall flashing assembly. Refer to drawings and specification section 042000 – Unit Masonry for related thru-wall flashing assembly materials.
3. Spacing: Provide at regular intervals, not to exceed 32-inches apart. Confirm locations with architect prior to installation.

2.8 MORTAR
A. Comply with requirements in Division 04 Section "Unit Masonry" for mortar materials and mixes.
   1. For setting mortar, use Type S.
   2. For pointing mortar, use Type N or O.

2.9 SEALER
A. After cast stone has been installed, installer shall seal with the following product:
   1. Products: STAINGUARD-50 as manufactured by Chemical Products Industries, Inc.
   2. Install per manufacturer’s written instructions.

2.10 SOURCE QUALITY CONTROL
A. Employ an independent testing agency to sample and test cast stone units according to ASTM C 1364.

PART 3 - EXECUTION
3.1 DELIVERY, STORAGE AND HANDLING
A. Piece Marks
   1. Clearly label each piece with project name, piece weight and corresponding identifier from shop drawings.

B. Packaging
   1. Protect cast stone pieces from staining or damage during shipping and storage.
   2. Provide pallet label consisting of job name, piece identifier and total pallet weight.
   3. Provide detailed shipping information consisting of each item per pallet per truck.

3.2 EXAMINATION
A. Installing contractor shall check Cast Stone materials for fit and finish prior to installation. Do not set unacceptable units. If unacceptable units are set, these will be rejected and will be required to be replaced.

3.3 SETTING CAST STONE IN MORTAR
A. Install cast stone units to comply with requirements in Division 04 Section "Unit Masonry."

B. Setting
   1. Drench units with clean water prior to setting.
   2. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
   3. Set units in full bed of mortar, unless otherwise detailed.
   4. Rake mortar joints 3/4 in. (18 mm) in. for pointing.
   5. Remove excess mortar from unit faces immediately after setting.
6. Tuck point unit joints to a slight concave profile.
   a. Set units in full bed of mortar with full head joints, unless otherwise indicated.
   b. Fill dowel holes and anchor slots with mortar.
   c. Fill collar joints solid as units are set.
   d. Build concealed flashing into mortar joints as units are set.
   e. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
   f. Keep joints at shelf angles open to receive sealant.

7. Lifting inserts exposed to view, including the top sides of parapet and wall caps will not be accepted. Cast stone pieces shall be set with straps or similar methods as determined by the installer.

C. 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.

D. 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.

E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

F. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated. Keep joints free of mortar and other rigid materials.

G. Prepare joints indicated to receive sealant and apply sealant of type and at locations indicated to comply with applicable requirements in Division 07 Section "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 due to warpage of units.

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.
   1. Replace units in a manner that shows no evidence of replacement.

B. Repair
   1. Repair chips with touchup materials furnished by manufacturer.
   2. Saturate units to be cleaned prior to applying an approved masonry cleaner.
3. Consult with manufacturer for appropriate cleaners

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 to comply with requirements in Division 04 Section "Unit Masonry."

E. Do not field apply water repellent until repair, cleaning, inspection and acceptance is completed.

END OF SECTION 04 72 00
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fabrication and erection of structural steel work, as shown on the drawings and specified herein. Work shall include, but not be limited to the following items:

1. Structural steel
2. Base and bearing plates.
3. Deck support angles and framing for roof openings.
4. Steel lintel members for masonry openings.
5. Edge angles and bent plates.
6. Connection plates.
7. Shear stud connectors.
8. All other steel items as listed in AISC – “Code of Standard Practice for Steel Buildings and Bridges” as shown on structural and architectural drawings.

B. Work shall also include grouting of all structural steel members where indicated.

C. Structural notes indicated on the drawings regarding structural steel framing should be considered a part of this specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.
B. Section 03 30 00 - Cast-in-Place Concrete.
C. Section 05 21 00 - Steel Joists.
D. Section 05 31 00 - Steel Deck.
E. Section 05 40 00 - Cold-Formed Steel Framing Systems.
F. Section 05 50 00 - Metal Fabrications.
G. Section 05 51 00 - Metal Stairs.

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1. AISC - Specification for Structural Joints Using High-Strength Bolts.
2. AISC 303 - Code of Standard Practice for Buildings and Bridges.
3. AISC 360-10 - Specification for Structural Steel Buildings.
10. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
13. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
17. ASTM A1085 - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).
27. SSPC - Steel Structures Painting Council.

1.4 TESTING AND INSPECTION

A. Special Inspection and Testing:

1. In accordance with Chapter 17 of the International Building Code, the Owner shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704.0.

2. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.

3. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.

4. Duties of the Special Inspection Agency:

   a. Perform all testing and inspection required per approved testing and inspection program.
b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.

c. Submit a final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency’s knowledge in conformance with the approved plans and specifications.

5. Structural Component Testing and Inspection Schedule for Section 05 12 23 is as follows:

<table>
<thead>
<tr>
<th>AISC 360 – CHAPTER N: STRUCTURAL STEEL QUALITY ASSURANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>O – Observe these items on a random basis. Operations need not be delayed pending these inspections.</td>
</tr>
<tr>
<td>P – Perform these tasks for each welded joint or member.</td>
</tr>
</tbody>
</table>

**Inspection Tasks Prior to Welding**

<table>
<thead>
<tr>
<th>Task Description</th>
<th>O/P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding procedure specifications (WPSs) available</td>
<td>P</td>
</tr>
<tr>
<td>Manufacturer certifications for welding consumables available</td>
<td>P</td>
</tr>
<tr>
<td>Material identification (type / grade)</td>
<td>O</td>
</tr>
<tr>
<td>Fit-up of groove welds (including joint geometry)</td>
<td>O</td>
</tr>
<tr>
<td>- Joint preparation</td>
<td></td>
</tr>
<tr>
<td>- Dimensions (alignment, root opening, root face, bevel)</td>
<td></td>
</tr>
<tr>
<td>- Cleanliness (condition of steel surfaces)</td>
<td></td>
</tr>
<tr>
<td>- Tacking (tack weld quality and location)</td>
<td></td>
</tr>
<tr>
<td>- Backing type and fit (if applicable)</td>
<td></td>
</tr>
<tr>
<td>Configuration and finish of access holes</td>
<td>O</td>
</tr>
<tr>
<td>Fit-up of fillet welds</td>
<td>O</td>
</tr>
<tr>
<td>- Dimensions (alignment, gaps at root)</td>
<td></td>
</tr>
<tr>
<td>- Cleanliness (condition of steel surfaces)</td>
<td></td>
</tr>
<tr>
<td>- Tacking (tack weld quality and location)</td>
<td></td>
</tr>
</tbody>
</table>

**Inspection Tasks During Welding**

<table>
<thead>
<tr>
<th>Task Description</th>
<th>O/P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of qualified welders</td>
<td>O</td>
</tr>
<tr>
<td>Control and handling of welding consumables</td>
<td>O</td>
</tr>
<tr>
<td>- Packaging</td>
<td></td>
</tr>
<tr>
<td>- Exposure Control</td>
<td></td>
</tr>
<tr>
<td>No welding over cracked tack welds</td>
<td>O</td>
</tr>
<tr>
<td>Environmental conditions</td>
<td>O</td>
</tr>
<tr>
<td>- Wind speed within limits</td>
<td></td>
</tr>
<tr>
<td>- Precipitation and temperature</td>
<td></td>
</tr>
<tr>
<td>WPS followed</td>
<td>O</td>
</tr>
<tr>
<td>- Settings on welding equipment</td>
<td></td>
</tr>
<tr>
<td>- Travel speed</td>
<td></td>
</tr>
<tr>
<td>- Selected welding materials</td>
<td></td>
</tr>
<tr>
<td>- Shielding gas type / flow rate</td>
<td></td>
</tr>
<tr>
<td>- Preheat applied</td>
<td></td>
</tr>
<tr>
<td>- Interpass temperature maintained (min. / max.)</td>
<td></td>
</tr>
<tr>
<td>- Proper position (F,V,H, OH)</td>
<td></td>
</tr>
</tbody>
</table>
**AISC 360 – CHAPTER N: STRUCTURAL STEEL QUALITY ASSURANCE**

O – Observe these items on a random basis. Operations need not be delayed pending these inspections.

P – Perform these tasks for each welded joint or member.

<table>
<thead>
<tr>
<th>Welding techniques</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Interpass and final cleaning</td>
<td></td>
</tr>
<tr>
<td>• Each pass within profile limitations</td>
<td></td>
</tr>
<tr>
<td>• Each pass meets quality requirements</td>
<td></td>
</tr>
</tbody>
</table>

**Inspection Tasks After Welding**

<table>
<thead>
<tr>
<th>Welds cleaned</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size, length, and location of welds</td>
<td>P</td>
</tr>
</tbody>
</table>

Welds meets visual acceptance criteria

- Crack prohibition
- Weld / base-metal fusion
- Crater cross section
- Weld profiles
- Weld size
- Undercut
- Porosity

| Arc strikes | P |
| k-area: when welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks within 3 inches of the weld | P |
| Backing removed and weld tabs removed and finished (if required) | P |
| Repair activities | P |
| Document acceptance or rejection of welded joint or member | P |

**Nondestructive Testing of Welded Joints**

For structures in Risk Category III or IV, ultrasonic testing shall be performed on all CJP groove welds subject to transversely applied tension loading in butt, T- and corner joints, in materials 5/16 in. thick or greater. Refer to AISC 360-10, section N.5e for reduction of rate of ultrasonic testing.

Thermally cut surfaces of access holes shall be tested using magnetic particle testing or penetrant testing, when the flange thickness exceeds 2 inches for rolled shapes or when the web thickness exceeds 2 inches for built-up shapes. Any crack shall be deemed unacceptable.

Welded joint subjected to fatigue shall be tested by radiographic or ultrasonic inspection. The reduction rate of ultrasonic testing is prohibited.

**Inspection Tasks Prior to Bolting**

| Manufacturer’s certifications available for fastener materials | P |
| Fasteners marked in accordance with ASTM requirements | O |
| Proper fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane) | O |
| Proper bolting procedure selected for joint detail | O |
| Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements | O |
| Pre-installation verification testing by installation personnel observed and documented for fastener assemblies and methods used | O |
| Proper storage provided for bolts, nuts, washers and other fastener components | O |
AISC 360 – CHAPTER N: STRUCTURAL STEEL QUALITY ASSURANCE

O – Observe these items on a random basis. Operations need not be delayed pending these inspections.
P – Perform these tasks for each welded joint or member.

<table>
<thead>
<tr>
<th>Inspection Tasks During Bolting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fastener assemblies, of suitable condition, placed in all holes and washers (if required) are</td>
</tr>
<tr>
<td>positioned as required.</td>
</tr>
<tr>
<td>Joint brought to the snug condition, placed in all holes and washers (if required) are</td>
</tr>
<tr>
<td>positioned as required.</td>
</tr>
<tr>
<td>Fastener component not turned by the wrench prevented from rotating</td>
</tr>
<tr>
<td>Fasteners are pretensioned in accordance with RCSC Specification, progressing</td>
</tr>
<tr>
<td>systematically from the most rigid point toward the free edges</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inspection Tasks After Bolting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Document acceptance or rejection of bolted connections</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Inspection Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection during the placement of anchor rods and other embedments supporting structural</td>
</tr>
<tr>
<td>steel. As a minimum, the diameter, grade, type and length of anchor rod or embedded item, and</td>
</tr>
<tr>
<td>the extent or depth of embedment into the concrete shall be verified.</td>
</tr>
<tr>
<td>Inspect the fabricated steel or erected steel frame to verify compliance with the details</td>
</tr>
<tr>
<td>shown on the construction documents, such as braces, stiffeners, member locations and</td>
</tr>
<tr>
<td>proper application of joint details at each connection.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inspection of Steel Elements of Composite Construction Prior to Concrete Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placement and installation of steel deck</td>
</tr>
<tr>
<td>Placement and installation of steel headed stud anchors</td>
</tr>
<tr>
<td>Document acceptance or rejection of steel elements</td>
</tr>
</tbody>
</table>

1.5 QUALITY ASSURANCE

A. Fabrication, Erection, and Welding Qualifications:

1. Fabricate structural steel members in accordance with AISC Specification for the design,    |
fabrication and erection of structural steel for buildings.

2. All welding of structural steel shall be performed by operators who have been recently    |
qualified as prescribed in “Qualification Procedures” of the American Welding Society (AWS).

3. Information provided on paper-based contract documents will govern over information provided |
in electronic model transfer.

4. Tolerances: Tolerances shall be as indicated by the AISC Code of Standard Practice for      |
Buildings and Bridges, except that tolerances for fabricating, rolling, cambering and erection    |
shall not be cumulative.
1.6 SUBMITTALS

A. Shop Drawings:

1. Prepare and submit complete erection and detailed shop drawings for Engineer’s approval, including framing plans indicating size, weight and location of all structural members. Shop drawings shall indicate methods of connecting, anchoring, fastening, bracing and attaching work of other trades.
   
   a. Where contract documents indicate verify in field (VIF) dimensions, shop drawings shall indicate these dimensions and Contractor shall note that the dimensions have been verified.
   
   b. This specification modifies AISC Code of Standard Practice by deleting the following sentence from 4.4.1(c): “Release by the Owner’s Designated Representatives for Design and Construction for the Fabricator to begin fabrication using the approved submittals.” Review of the shop drawings by the Engineer shall not relieve the fabricator of this responsibility.

2. Furnish both the Engineer and Architect with one copy of the following:
   
   a. Final shop drawings containing all review notations.
   b. Field Use/For Construction drawings.

3. The steel fabricator shall submit a setting plan for all embedded items for Engineer’s approval.

4. Welder’s Certification: Submit certification for all welders employed on the project demonstrating they have been AWS qualified to perform the welding procedures required for this project.

5. General Contractor/Construction Manager to provide copies of field concrete cylinder breaks indicating the concrete meets 75% of the design compressive strength to the steel erector.

B. Product Data:

1. Certified copies of material test reports, commonly called mill test reports, for all structural steel used on the project. Material test reports shall comply with the requirements of ASTM A6, shall cover chemical and physical properties, and shall be accompanied by a Certificate of Compliance from the fabricator.

2. Manufacturer specifications, certifications, and installation recommendations for the following products, including laboratory test reports and other data required to prove compliance with these specifications:
   
   a. High strength bolts, including nuts and washers.
   b. Unfinished bolts and nuts
3. The Contractor shall submit written procedures for the pre-installation testing, installation, snugging, pretensioning, and post-installation inspection of fasteners. The procedure(s) shall meet all requirements of the RCSC specification and the drawings. Procedures need to be submitted only for the method(s) of installation to be used by the Contractor, which may include the turn-of-nut, calibrated wrench, twist-off type tension control bolt, and direct tension indicator methods.

4. Shear Connectors: Contractor shall submit the following:
   
a. Certifications that the studs, as supplied, meet the requirements of AWS D1.1, Sections 7.2 and 7.3.

b. Certified copies of the stud manufacturer’s test reports covering the last completed set of in-plant quality control mechanical tests for the diameter supplied.

c. Certified material test reports from the steel supplier indicating diameter, chemical properties, and grade on each heat number supplied.

d. Certificate of Compliance from the Contractor.

5. Prepare and submit product data for Engineer’s approval for shop applied primers, finished paint system, expansion and/or adhesive anchors, non-shrink grout and other miscellaneous materials.

D. LEED Certification: Submit manufacturer’s certification for each steel product including the following:

1. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer’s name, product cost and location of extraction or harvest of raw materials.

### 1.7 DELIVERY, STORAGE AND HANDLING

A. Steel members shall be transported, stored and erected in a manner that will avoid any damage or deformation. Materials should be stored to allow easy access for inspection and identification. Bent or deformed members will be rejected and shall be replaced or repaired at the expense of the responsible party. Store clear of the ground and in such a manner as to eliminate excessive handling.

B. Store fasteners in a protected location. Clean and re-lubricate bolts and nuts before use.

### PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Structural Steel:

1. All structural steel shall be free from defects impairing strength, durability or appearance. All structural steel shall meet the latest minimum requirements as follows:

   a. Structural steel wide flange shapes shall:

      1) Conform to the ASTM designations listed in the General Notes of the drawings, unless noted otherwise.
b. Structural steel angles, channels, bars, plates, and miscellaneous shall conform to the ASTM designations listed in the General Notes of the drawings.

1) Shapes of ASTM A572, Grade 50, mill certified to AISC Technical Bulletin #3 requirements, may be substituted for A992 with approval from the Structural Engineer of Record (SEOR).

2) Grade 50 steel shall have a minimum yield stress of 50 ksi and the yield stress, $F_y$, that is reported from tests shall be based on the yield strength definition in ASTM A370, using the offset method at 0.002 strain.

c. Square and rectangular structural tubing shall be cold formed conforming to the ASTM designations listed in the General Notes of the drawings.

d. Round structural tubing shall be cold formed conforming to the ASTM designations listed in the General Notes of the drawings.

e. Steel pipe shall conform to the ASTM designations listed in the General Notes of the drawings.

B. High Strength Structural Bolts:

1. High strength structural bolts shall conform to the ASTM designations listed in the General Notes of the drawings.

2. High strength bolts shall be detailed and installed in accordance with AISC - “Specification for Structural Joints Using High-Strength Bolts.”

3. Manufacturer’s symbol and grade markings shall appear on all bolts and nuts.

C. Anchoring Devices:

1. Anchor Rods: Anchor rods used with structural steel members shall be plain threaded rods conforming to the ASTM designations listed in the General Notes of the drawings.

2. Expansion Anchors: Expansion anchors shall consist of one-piece wedge type carbon steel anchors with heavy-duty nuts and washers. All components shall be zinc plated in accordance with ASTM B633. Refer to the drawing details and General Notes for the expansion anchors used as the basis of design and the acceptable alternates.

3. Adhesive Anchoring System: Adhesive anchoring system shall consist of a threaded anchor rod complete with nut and washer and the adhesive cartridge. Refer to the drawing details and General Notes for the adhesive anchoring systems used as the basis of design and the acceptable alternates.

a. Nuts shall meet ASTM A563, Grade DH, and washers shall meet ASTM F436.

b. All components shall be zinc plated in accordance with ASTM B633 SC1.
c. Adhesive shall consist of a two-part acrylic based adhesive applied in a dual cartridge dispensing system that properly mixes the components at the point of application.

D. Welding Materials:

1. Type required for material being welded in conformance with AWS D1.1.

E. Stud Connectors:

1. For threaded studs that are being used to connect steel beams to embed plates, use ASTM A108, Type A, Grades 1010 through 1020 forged steel, headed uncoated with a minimum tensile strength of 61,000 psi. Fabricated within the tolerances set forth in AWS D1.1.

2. For shear connectors that are being used on steel beams in concrete slabs for composite shear transfer and embedded steel members, use ASTM A108, Type B, Grades 1010 through 1020 forged steel, headed uncoated with a minimum tensile strength of 65,000 psi. Fabricated within the tolerances set forth in AWS D1.1.

3. Studs applied by means of the electric arc welding process and shall use an arc shield ferrules of heat resistant ceramic.

F. Galvanizing: Where indicated on the drawings, steel shall be galvanized by the hot-dip process after fabrication conforming to ASTM A123. All exterior steel that will remain exposed shall be galvanized, unless otherwise indicated.

G. Paints and Primers:

1. Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer.
3. Refer to Specification Section 09 90 00 for additional paint requirements.

H. Non-Shrink Grout for Base and Bearing Plates: Non-shrink grout, conforming to ASTM C1107, shall be pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sand, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents. All constituents shall meet the requirements of these specifications. Minimum compressive strength at 28-days shall be 7,000 psi as determined by ASTM C109. Follow manufacturer’s instructions for handling, mixing, placing and curing. Acceptable products are:

1. Euclid Chemical Company - Euco N.S. Grout
2. L&M Construction Chemical - Crystex.
3. Master Builders - Masterflow 713.
4. Sonneborn - Sonnogruut.
5. Five Star Products Inc. – Five Star Grout.
2.2 FABRICATION AND MANUFACTURE

A. Fabrication Procedures (non-AESS):

1. Fabricate all structural steel items in accordance with AISC Specifications and as indicated on the approved shop drawings.

2. Provide camber in structural members where indicated.

3. Properly mark materials for field assembly and location for which intended. Fabricate for delivery sequence that will expedite erection and minimize handling of materials.

4. Complete structural steel assemblies before shop priming or galvanizing.

B. Shop Connections:

1. All shop connections shall be welded, unless noted otherwise on drawings. Connections shall develop the full strength of the adjoining members unless detailed otherwise.

2. All holes shall be either drilled or punched, as no burning of holes will be permitted, including the enlargement of holes. Provide all holes required for connections and for attaching the work of other trades where such holes are shown if furnished prior to fabrication.

3. Connections shall be detailed as standard framed beam connections (bearing type) in accordance with the AISC Manual of Steel Construction - Allowable Stress Design. Connections which require oversized holes or slotted holes in which the force is other than normal to the axis of the slot shall be detailed as “Slip-Critical Connections” and noted as such on the erection drawings. Provide bearing plates and end anchorage for beams resting on masonry.

4. All full and partial penetration welds shall be fully detailed on the shop drawings. Use backing for all full penetration welds.

5. Weld access holes shall be fabricated in accordance with the recommendations of AWS D1.1 and AISC Specification.

C. Shear Connectors:

1. Steel stud shear connectors shall be securely welded in the field to structural steel beams as detailed on the drawings. Welds shall be such that the shear connector stud will deform before weld failure occurs. Welding shall be done in accordance with AWS D1.1.

2. Shear stud connector for embedded plates and angles shall be welded in the fabrication shop in accordance with AWS D1.1.

D. Deck support framing and seats: Furnish all miscellaneous framing necessary to fully support the roof and floor steel decking.
E. Shop Priming:

1. Unless noted otherwise below, structural steel shall not be shop primed.

2. The following are steel surfaces to receive shop priming:
   a. Surfaces to be painted per Architect’s drawings.

3. If the steel pieces are to be shop primed, the following surfaces are exceptions to shop priming:
   a. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   b. Surfaces to be field welded.
   c. Surfaces to be high-strength bolted with slip-critical connections.
   d. Top flanges of beams supporting composite steel decking.
   e. Surfaces to receive sprayed fire-resistant materials.
   f. Galvanized surfaces.

4. Surface Preparation: Clean Surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   a. SSPC-SP3, “Power Tool Cleaning.”

5. Priming: Apply primer in accordance with paint manufacturer’s recommendations, and at a rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

F. Finished Paint System:

1. Finished paint coats shall be in accordance with paint manufacturer’s recommendations, and specification Division 9.

2. Paint shall be free of sags, runs, drips or other defects. Allow ample drying time before handling to prevent damage to coatings.

3. Strip paint corners, crevices, bolts, welds, and sharp edges.

4. Apply two coats of shop paint to surfaces that will be inaccessible after assembly or erection. Change color of the second coat to distinguish it from the first.

G. Galvanizing:

1. Hot-Dip Galvanized Finish: Apply Zinc coating by the hot-dip process to structural steel according to ASTM A 123.
   a. Fill vent holes and grind smooth after galvanizing.
   b. Unless otherwise noted on drawings or in Division 9, all exterior steel components exposed to the elements shall be galvanized, including, but not limited to, lintels.
2.3 LEED CREDIT

A. LEED Credit MRc 5.1/5.2:
   1. Steel products shall be manufactured within 500 miles of project site. Recycled scrap products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Erection Procedures:
   1. The erector and not the SEOR shall be responsible for the means, methods and safety of erection of the structural steel framing.
   2. Erection of all structural steel items shall meet the requirements of AISC “Specification and Code of Standard Practice.”
   3. All work shall be erected square, plumb, straight and true, accurately fitted and with tight joints and intersections, by mechanics experienced in the erection of structural steel. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
   4. Clean the bearing surface and other surfaces that will be in permanent contact before assembly.
   5. All base plates shall be supported on steel wedges, steel shims or heavy duty leveling nuts until the supported members have been leveled and plumbed.
      a. Snug tighten anchor rods after supported members have been positioned and plumb. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
      b. Promptly place non-shrink grout between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturers written installation instructions for shrinkage-resistant grouts.
   6. Field connections of structural work shall be made with either high strength bolts (bearing type) or by welding. Proper precaution shall be taken to ensure that anchored items will not be distorted or overstressed due to improperly fabricated items.
   7. Splice members only where indicated unless, with the SEOR’s approval, splices not indicated would result in lower costs due to reduced shipping expense. For splices not indicated, submit structural calculations prepared under direct supervision of and signed by a Professional Engineer licensed in the state where the project is located.
8. Do not use thermal cutting during erection unless approved by the Engineer/Architect in writing.

9. Steel erection shall not proceed without concrete in footings, piers, and walls attaining 75% of the intended minimum compressive design strength. Documentation must be provided indicating compliance with this requirement.

B. Surveys:

1. Establish permanent benchmarks necessary for accurate erection of structural steel.

2. Check elevations of concrete surfaces, and locations of anchor bolts and similar items, before erection proceeds.

C. Bracing and Protection:

1. Steel shall be well plumbed, leveled and braced to prevent any movement.
   a. Contractor shall provide and maintain all necessary temporary guying of steel frame to resist safely all wind and construction loads during erection and to assure proper alignment of all parts of the steel frame.

2. Provide all temporary flooring, bracing, shoring and guards necessary to prevent damage or injury. All partially erected steel shall be secured in an approved manner during interruptions of work.

D. Anchor and Foundation Rods:

1. All anchor or foundation rods and similar steel items to be built into concrete or masonry are to be set by the concrete or masonry contractors and shall be furnished promptly so that they may be built in as the work progresses because cutting of structural steel members to accommodate errors pertaining to embedded items will not be permitted.

3.3 FIELD WELDING

A. Welding Procedures:

1. All field welding shall be in accordance with AISC Specifications and conform to AWS D1.1 "Structural Welding Code - Steel".
   b. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC’s “Code of Standard Practice” for Steel Buildings and Bridges for mill material.

2. Contractor shall remove ceramic ferrules from shear connectors in sufficient time to allow for inspection of welds prior to placement of the concrete.
3.4 REPAIRS, PROTECTION, AND TOUCH UP

A. Repair damaged galvanized coatings and on galvanized items with galvanized repair paint according to ASTM A780 and manufacturer’s written instructions.

B. Touch up Painting: After installation, promptly clean, prepare, and prime or reprime field welds, final connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates and abutting structural steel.
   1. Clean and prepare surfaces by SSPC-SP2 hand-tool cleaning or SSPC-SP3 power-tool cleaning.
   2. Apply a compatible primer of the same type as shop primer used on adjacent surfaces.
   3. Secure approval by the Architect prior to field painting.

3.5 GROUTING

A. Grouting under structural framing members shall be completed after all members have been plumbed and braced and before imposed loads are placed thereon.

B. Remove all defective concrete, dirt, oil, grease and other foreign matter from surfaces to which grout will be placed.

3.6 MISCELLANEOUS STEEL AND STEEL LINTELS

A. Furnish and install all miscellaneous steel as detailed in architectural and structural drawings.

B. The steel fabricator shall furnish all steel lintels required for masonry wall construction indicated in the architectural and structural drawings and schedules.

C. Provide additional steel framing for continuous support of steel deck edges at openings and column interruptions.

D. All exterior exposed steel shall be hot-dip galvanized in accordance with ASTM A123 painted in accordance with Division 9 after fabrication.

END OF SECTION 05 12 23
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fabrication and erection of open web steel joists. Work shall include but not be limited to, the following items:
   2. LH-series joists.
   4. Bridging.
   5. Joist anchors and connections.

B. Structural notes indicated on the drawings regarding steel joists shall be considered a part of this specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.
B. Section 03 30 00 - Cast-in-Place Concrete.
C. Section 03 41 00 - Structural Precast Concrete.
D. Section 04 22 00 - Reinforced Unit Masonry.
E. Section 05 12 23 - Structural Steel.
F. Section 05 31 00 - Steel Deck.

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

   1. AISC 303 - Code of Standard Practice for Buildings and Bridges.
   11. SSPC - Steel Structures Painting Council.
1.4 TESTING AND INSPECTION

A. Special Inspection and Testing:

1. In accordance with Chapter 17 of the International Building Code, the Owner shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704.0.

2. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.

3. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.

4. Duties of the Special Inspection Agency:

   a. Perform all testing and inspection required per approved testing and inspection program.

   b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.

   c. Submit a final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency’s knowledge in conformance with the approved plans and specifications.

5. Structural Component Testing and Inspection Schedule for Section 05 21 00 is as follows:

<table>
<thead>
<tr>
<th>Open-Web Steel Joists</th>
<th>Continuous</th>
<th>Periodic</th>
<th>Referenced Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation of open-web steel joists.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End connections - welding or bolted</td>
<td></td>
<td>X</td>
<td>SJI Specifications listed in Section 2207.1</td>
</tr>
<tr>
<td>Bridging - horizontal or diagonal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Standard bridging</td>
<td></td>
<td>X</td>
<td>SJI Specifications listed in Section 2207.1</td>
</tr>
<tr>
<td>2. Bridging that differs from the SJI specifications listed in Section 2207.1.</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in performing the work of this section with minimum ten (10) years documented experience. Fabrication company shall be certified by the Steel
The Joist Institute (SJI) to manufacture joists complying with the SJI Standard Specifications and Load Tables.

B. Manufacturer shall assume responsibility for engineering special joists indicated on the drawings to comply with the SJI standard specification performance requirements. This responsibility includes the preparation of shop drawings and comprehensive engineering analysis by a qualified Structural Engineer licensed in the state where the project is located.

1.6 SUBMITTALS

A. Prepare and submit shop and erection drawings for Engineer’s approval.

B. Shop drawings:
   1. Indicate standard designations, configuration, sizes, spacing, location of joists, joist chord extensions.
   2. Joining and anchorage details of attachment to other construction.
   3. Size, location and configuration of all code required bridging, bracing and connections.
   5. Type of paint and shop primer.
   6. Dimensions verifying that field measurements are as shown on the drawings.

C. Welder’s Certificates: Submit certification for all welders employed on the project demonstrating they have been AWS qualified to perform the welding procedures required for this project.

D. LEED Certification: Submit manufacturer’s certification for each steel product including the following:
   1. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer’s name, product cost and location of extraction or harvest of raw materials.

1.7 DELIVERY, STORAGE AND HANDLING

A. All joists and accessories shall be transported, stored and erected in a manner, which will prevent any damage or deformation. Damaged joists shall not be erected or repaired without Structural Engineer’s approval. Joists shall be stored clear of the ground in such a manner so as to eliminate excessive handling, and protect from weather with a weatherproof covering.

B. Deliver and store all joists and accessories to the site according to all SJI requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bar Joists: Steel used in the manufacture of bar joists shall be as allowed by the Steel Joist Institute (SJI) standard specification for chord and web members.
B. High Strength Bolts and Nuts: ASTM F3125, Grade A325, Type 1 heavy hex steel structural bolts, heavy hex carbon steel nuts, and hardened carbon steel washers. Finish shall be plain, uncoated.

C. Carbon Steel Bolts and Threaded Fasteners: ASTM A307, Grade A, carbon steel, hex head bolts and threaded fasteners; carbon steel nuts; and flat unhardened steel washers. Finish shall be plain, uncoated mechanically deposited zinc coating, ASTM B695, Class 50.

D. Miscellaneous items, such as bridging, headers, bolts, nuts, washers, anchors and all other appurtenances for a complete metal joist installation shall be furnished as a part of the work of this section.

E. Primer: Provide the manufacturer’s standard shop primer with good resistance to normal atmospheric corrosion and complying with the performance requirements specified in the SJI “Standard Specification” previously cited.

1. Do not prime paint joists and accessories scheduled to receive spray applied fireproofing.

2. Contractor shall certify compatibility of shop primer coat with field applied paint finishes.

F. Welding Materials: AWS D1.1; type required for materials being welded.

2.2 FABRICATION AND MANUFACTURE

A. Manufacture K-Series steel joists according to “Standard Specification for Open Web Steel Joists, K-Series,” in SJI “Specifications,” with steel angle top and bottom chord members, underslung ends, and parallel top chords; of joist type indicated.

B. All steel joists shall consist of an electrically welded open-web type, designed and fabricated to conform to the “Standard Specifications” included in the SJI or AISC publications cited above and shall be manufactured by a current member of the Steel Joist Institute.

C. Provide holes in chord members for connecting and securing other construction to joists. General Contractor shall coordinate this information and provide the manufacturer with drawings outlining the location of any required holes.

D. Bridging members for open web joists, unless otherwise indicated on the drawings, shall be continuous wall to wall, complete with suitable anchorage at each end, all in accordance with SJI “Standard Specifications”.

E. Design and fabricate joists and bridging to support a minimum net uplift as indicated on the drawings. A 1/3 stress increase shall not be used in uplift design.

F. Camber joists in accordance with SJI Standard Specification

G. All steel joists including all accessories, before leaving the shop shall be thoroughly cleaned of all mill scale, rust and foreign matter and shall be given one (1) coat of primer complying with the performance requirements specified in the SJI “Standard Specification” previously cited.

H. Provide bottom and top chord extensions as indicated on the drawings. Top chord extensions shall be SJI’s Type S.
I. Provide extended bearing ends of joists with SJI’s Type R extended ends where indicated on the drawings.

2.3 CLEANING, PRIMING AND PAINTING

A. Clean joist by using solvent cleaning, SSPC-SP 1 to remove oil and grease.

B. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories to be primed using a combination of hand-tool cleaning, SSPC-SP 2 and power-tool cleaning, SSPC-SP 3.

C. Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous dry film thickness of not less than 1 mil.

D. Painting of joists and joist accessories is specified in Division 9 Section "Painting."

2.4 LEED CREDIT

A. LEED Credit MRc 5.1/5.2:

1. Steel products shall be manufactured within 500 miles of project site. Recycled scrap products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 ERECTION

A. Erection of all steel joist items shall meet the applicable requirements of the SJI “Standard Specifications” previously cited.

B. All anchor bolts, wall anchors, bridging anchors, bearing plates and similar items to be built into concrete or masonry are to be set by the concrete or masonry contractors and shall be furnished promptly so that they may be built-in as the work progresses as no cutting for the same afterward will be permitted. Beginning of installation means erector accepts existing conditions.

C. All steel joists shall be accurately set to the lines, elevations and dimensions indicated on the approved shop drawings.

D. Bridging shall be installed concurrently with joist erection and before loads are applied. Bridging shall be securely welded to joist chords in a manner that will not damage joist members and so as to insure positive resistance to both tensile and compressive stresses. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

E. All joists bearing on concrete or masonry shall bear on a steel bearing plate and joists bearing on steel shall be welded to the supporting steel.

F. All field welding shall be in accordance with AWS previously cited.

G. All construction loads shall be kept off joists until they are permanently anchored and bridged. During construction, care shall be taken to avoid excessive concentrated or moving loads. Provide for adequate distribution of any such loads so that the carrying capacity of the joists is not exceeded.
H. Joist shall not be positioned any greater than 1/4 inch from true alignment, and shall not vary more than 1/4 inch from plumb.

3.2 FIELD TOUCH UP

A. Immediately after erection, Contractor shall touch up all erection bolts, all field welds and all scratched or abraded areas and paint out erection markings with matching rust-inhibitive primer in color and formulation to match shop primer.

END OF SECTION 05 21 00
SECTION 05 31 00
STEEL DECK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fabrication and erection of steel deck. The Work shall include, but not be limited to the following:

1. Roof deck, roof deck accessories, and roof deck fasteners.
2. Acoustical roof deck, acoustical insulation component and accessories.

B. Structural notes indicated on the drawings regarding steel decking shall be considered a part of this specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.
B. Shear studs.
C. Section 03 30 00 - Cast-in-Place Concrete.
D. Section 05 12 23 - Structural Steel.

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.
4. ASTM A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
7. AWS D1.1 - Structural Welding Code - Steel.
8. AWS D1.3 - Structural Welding Code - Sheet Steel.
10. SDI Floor Deck Design Manual.

1.4 TESTING AND INSPECTION

A. Special Inspection and Testing:

1. In accordance with Chapter 17 of the International Building Code, the Owner shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704.0.
2. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.

3. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.

4. Duties of the Special Inspection Agency:
   a. Perform all testing and inspection required per approved testing and inspection program.
   b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.
   c. Submit a final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency’s knowledge in conformance with the approved plans and specifications.

5. Structural Component Testing and Inspection Schedule for Section 05 31 00 is as follows:

<table>
<thead>
<tr>
<th>Inspection Tasks Prior to Deck Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verify compliance of materials (deck and all deck accessories) with construction documents, including profiles, material properties, and base metal thickness</td>
</tr>
<tr>
<td>Document acceptance or rejection of deck and deck accessories</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inspection Tasks After Deck Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verify compliance of deck and all deck accessories installation with construction documents</td>
</tr>
<tr>
<td>Verify deck materials are represented by the mill certifications that comply with the construction documents</td>
</tr>
<tr>
<td>Document acceptance or rejection of installation of deck and deck accessories</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inspection Tasks Prior to Welding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding procedure specifications (WPS) available</td>
</tr>
<tr>
<td>Manufacturer certifications for welding consumables available</td>
</tr>
<tr>
<td>Material identification (type / grade)</td>
</tr>
<tr>
<td>Check welding equipment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inspection Tasks During Welding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of qualified welders</td>
</tr>
<tr>
<td>Control of handling of welding consumables</td>
</tr>
<tr>
<td>Environmental conditions (wind speed, moisture, temperature)</td>
</tr>
<tr>
<td>WPS followed</td>
</tr>
</tbody>
</table>
SDI - QA / QC STANDARD FOR STEEL DECK INSTALLATION

O – Observe these items on an intermittent basis
P – Perform these tasks prior to final acceptance for each item or element.

### Inspection Tasks After Welding

<table>
<thead>
<tr>
<th>Task</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verify size and location of welds, including support, sidelap, and perimeter welds</td>
<td>P</td>
</tr>
<tr>
<td>Welds meet visual acceptance criteria</td>
<td>P</td>
</tr>
<tr>
<td>Verify repair activities</td>
<td>P</td>
</tr>
<tr>
<td>Document acceptance or rejection of welds</td>
<td>P</td>
</tr>
</tbody>
</table>

### Inspection Tasks Prior to Mechanical Fastening

<table>
<thead>
<tr>
<th>Task</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer installation instructions are available for mechanical fasteners</td>
<td>O</td>
</tr>
<tr>
<td>Proper tools are available for fastener installation</td>
<td>O</td>
</tr>
<tr>
<td>Proper storage for mechanical fasteners</td>
<td>O</td>
</tr>
</tbody>
</table>

### Inspection Tasks During Mechanical Fastening

<table>
<thead>
<tr>
<th>Task</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasteners are positioned as required</td>
<td>O</td>
</tr>
<tr>
<td>Fasteners are installed in accordance with manufacturer's instructions</td>
<td>O</td>
</tr>
</tbody>
</table>

### Inspection Tasks After Mechanical Fastening

<table>
<thead>
<tr>
<th>Task</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check spacing, type, and installation of support fasteners</td>
<td>P</td>
</tr>
<tr>
<td>Check spacing, type, and installation of sidelap fasteners</td>
<td>P</td>
</tr>
<tr>
<td>Check spacing, type, and installation of perimeter fasteners</td>
<td>P</td>
</tr>
<tr>
<td>Verify repair activities</td>
<td>P</td>
</tr>
<tr>
<td>Document acceptance or rejection of mechanical fasteners</td>
<td>P</td>
</tr>
</tbody>
</table>

### QUALITY ASSURANCE

A. Fabricator: Company specializing in performing the work of this section with minimum five (5) years documented experience at manufacturing steel deck. Fabrication Company shall be a current member of the Steel Deck Institute (SDI).

B. Erector: Company specializing in performing the work of this section with minimum five (5) years documented experience at erecting steel deck.

C. Welding: Qualify Welding Procedure Specifications (WPS) and welding operators in accordance with AWS D1.3. Provide certifications that welders to be employed in the construction have satisfactorily passed AWS qualification tests. If recertification of welders is required, retesting will be the contractor’s responsibility.

D. Furnish and install steel deck in accordance with the manufacturer’s current ICC Research Committee Report to obtain diaphragm values indicated.

### SUBMITTALS

A. Prepare and submit shop drawings for Engineer’s approval. Shop drawings shall indicate deck layout, depth, uncoated metal thickness, framing and supports with unit dimensions and sections, shear stud layout and complete end jointing. Contractor to verify measurements, lines, elevations, and details of field conditions to conform with actual conditions.
B. Provide details of all accessories.

C. Shop drawings shall also indicate typical welding or mechanical anchoring pattern for steel deck and accessories.

D. Prepare and submit allowable construction span tables and allowable total load tables for Engineer’s approval. Tables shall be accompanied with a letter of certification from the manufacturer stating the tabulated design values were determined in accordance with the Steel Deck Institute’s Design Manuals for Roof Deck, Floor Deck and Diaphragm Design.

   1. The gauges and section moduli indicated on the drawings or specified herein are minimum and the gauge and section modulus of the deck furnished shall meet or exceed these minimum requirements. All gauges are United States standard, measured prior to coating.

E. WPS and Procedure Qualification Records (PQR) shall be current and approved by the Structural Engineer of Record (SEOR).

F. Provide manufacturer’s latest recommendations and installation instructions.

G. Prepare and submit product data of proposed materials.

H. Drive pin fasteners: Provide manufacturer’s product data sheets, test data sheets and deck diaphragm design load tables to demonstrate their products capability to fasten the deck for the required structural loads.

I. LEED Certification: Submit manufacturer’s certification for each steel product including the following:

   1. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer’s name, product cost and location of extraction or harvest of raw materials.

1.7 DELIVERY, STORAGE AND HANDLING

A. All decking materials shall be transported, stored and erected in a manner that will prevent damage or deformation of sheets. Damaged material shall not be erected or repaired without Structural Engineer’s approval.

B. Deck panels shall be stored clear of the ground, elevated on one end, and protected from weather with waterproof covering.

1.8 COORDINATION

A. Coordinate the installation of the sound-absorbing insulation strips in the topside ribs of the acoustical deck with roof installation specified in Division 7 to ensure protection of insulation strips against damage from the effects of weather and other elements.
PART 2 - PRODUCTS

2.1 STEEL ROOF DECK

A. Standard Steel Roof Deck: Fabricate panels to comply with the “SDI Roof Deck Design Manual,” and the following:

1. Steel decking sheet material, minimum yield strength, depth, gage, profile, and finish are indicated on the drawings, as classified by Steel Deck Institute (SDI). Panels shall be formed with integral ribs and overlapping side flanges.

2.2 ACOUSTICAL STEEL ROOF DECK

A. Acoustical Steel Roof Deck: Fabricate panels to comply with the “SDI Roof Deck Design Manual,” and the following:

1. Steel decking sheet material, minimum yield strength, depth, gage, profile, and finish are indicated on the drawings, as classified by Steel Deck Institute (SDI). Panels shall be formed with integral ribs and overlapping side flanges.


3. Sound Absorbing Insulation: Provide the deck manufacturer’s standard premolded roll or strip glass fiber or mineral fiber insulation. Provide continuous wire mesh deck/insulation spacers for field painted decking.

4. Acoustical Performance: NRC = 0.95.

2.3 FASTENERS

A. Support Fasteners:

1. Welded: Refer to drawings for weld size and spacing requirements.

   a. Weld washers required for material less than 0.028” thick. Welding washers shall have a minimum thickness of 0.0598 inches and be applicable to AWS D1.3 type welding and of type as recommended by the deck manufacturer.

   b. Weld metal shall penetrate all layers of deck material and shall have good fusion to the supporting steel. Fasten ribbed deck to steel support members at ends and intermediate supports.

   1) All welding shall be in conformance with previously cited AWS recommendations in appearance and quality of welds, and the methods used in correcting welding work.

2. Hilti Drive Pins: Zinc coated carbon steel fasteners designed to be pneumatically driven into the structural steel supports of the decking. Refer to drawings to fastener spacing requirements.

   a. For use with steel bar joist and light structural steel framing supports:

      1) Hilti X-HSN 24 (1/8 inch up to and including 3/8 inch)
b. For use with structural steel framing supports:

1) Hilti X-ENP-19 (1/4 inch or thicker)

B. Side Lap Fasteners:

1. Mechanical: Zinc coated self-drilling, self-tapping type (minimum No. 10) steel screws. Refer to drawings for fastener spacing requirements.

2. Hilti Side Lap Connectors: Zinc coated, steel fasteners, S-SLC 01 M HWH or S-SCL 02 M HWH. These fasteners are to be used if the Hilti drive pin system is used for deck attachment to support steel. Refer to drawings for connector spacing requirements.

2.4 ACCESSORIES

A. Steel materials to conform to ASTM A108 meeting the requirements of ASTM A653, G60 coating.

B. Provide all closers, fillers, starters, sump pans, metal cant strips, ridge and valley plates, pour stops, column closures, girder fillers, and similar accessories required for a complete installation. Provide cover plates at all locations where direction of deck span changes. Unless otherwise noted, accessories shall be of the same steel sheet material, finish, and thickness as the deck sections.

C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

D. Recessed Sump Pans: Single piece steel sheet of same material, finish and thickness as the deck, with 3-inch-wide flanges and recessed pan of 1-1/2-inch minimum depth. Cut drain holes in the field.

2.5 LEED CREDIT

A. LEED Credit MRc 5.1/5.2:

1. Steel products shall be manufactured within 500 miles of project site. Recycled scrap products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 ERECTION

A. Verify that field conditions are acceptable and are ready to receive work. Correct inaccuracies in alignment or level before deck units are finally placed.

B. Deck units and deck accessories herein specified shall be thoroughly and securely erected by experienced workmen fastening to supporting steel members as herein specified. All work shall be in conformance with manufacturer’s latest printed recommendations and approved shop drawings.

C. Beginning of installation means installer accepts existing conditions.

D. The finished work shall be true, flat planes and to slopes indicated with end joints flush and without sharp protruding edges. Exposed underside of deck shall be true without defect.
E. Where large predetermined openings for elevators, stairs, ducts, and similar elements passing through the deck units occur, furnish prefabricated units to fit job conditions. Where other holes or openings are required in decking after erection, reinforce such holes as indicated on the drawings. Cantilever deck to the edge of slabs only as indicated on the drawings.

F. Burning of holes in decking will not be permitted.

G. Steel decking shall be installed to span supporting steel members at right angles. Panels shall be securely anchored to each structural support it rests on or passes.

H. Except where single spans are indicated, furnish decking in minimum lengths to span three.

3.2 ROOF DECK

A. Fasten roof deck panels to steel supporting members using welds, mechanical fasteners, drive pins as specified herein and on the drawings.

B. Deck shall be fastened through the bottom of the deck rib to all structural supports for the specific deck sections.

C. End bearing of roof decking shall have a minimum of 1-1/2 inches of bearing occurring over structural supports.

D. Install sound absorbing insulation into the topside ribs of the acoustical deck as specified in the deck manufacturer’s installation instructions. Coordinate with the roofing installation to protect the insulation from damage.

E. Place deck panels on structural supports and adjust to final position with ends aligned. Attach to supports immediately after placement.

F. Roof sump pans shall be installed over openings provided in roof deck with flanges welded to the top of the deck. Space welds at 12 inches apart with at least 1 weld in each corner.

G. Install all roof deck accessories in accordance with the roof deck manufacturer’s written instructions.

H. Installation of acoustical roof deck shall comply with the manufacturer’s written instructions. Fasteners, welds or other attachments methods shall be clean and/or shall not be visible from under the deck when viewed at 8-feet. Acoustical roof deck shall be handled and installed in a manner that will require minimal to no corrective work, including straightening, patching, bending, etc., prior to finishing.

3.3 FLOOR DECK

A. Fasten steel floor deck to supporting steel with welds, mechanical fasteners, drive pins, shear studs as specified herein and on the drawings.

B. Unless noted otherwise, secure side laps and perimeter edges of units with fasteners at mid-span between supports or 36 inches on center, whichever distance is smaller.

C. Place deck panels on structural supports and adjust to final position with ends aligned. Attach to supports immediately after placement.

D. Install deck ends over supports with a minimum end bearing of 1-1/2 inches.
E. Install pour stops and girder fillers to supporting structure according to manufacturer’s recommendations.

F. Fasten column closures and cell closures to deck to provide a tight fit. Provide cell closures at changes of direction of deck units, unless otherwise noted.

G. Install all floor deck accessories in accordance with the floor deck manufacturer’s written instructions.

3.4 FIELD TOUCH UP

A. After erection, all weld burn marks and abraded spots shall be cleaned and field painted with a rust-inhibiting metal primer matching formulations and color of shop coat or a zinc-rich rust inhibiting paint for galvanized deck surfaces.

END OF SECTION 05 31 00
SECTION 05 40 00
COLD-FORMED STEEL FRAMING (CFSF) SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Load bearing structural steel studs framing system of 18 to 12-gauge (43 mil to 97 mil) members along with fasteners and related accessories. Furnish and install cold-form steel framing, as shown on the drawings and specified herein. Work shall include, but not be limited to the following items:

1. Non-load bearing formed steel stud exterior parapet walls.
2. Provide tracks, blocking, lintels, clips angles, bridging, shoes, reinforcements, fasteners and accessories to construct a complete steel framing system.

B. Structural notes indicated on the drawings regarding cold-formed steel framing system shall be considered a part of this Specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.
B. Section 05 12 23 - Structural Steel.
C. Section 05 21 00 - Steel Joists.
D. Section 05 31 00 - Steel Deck.
E. Section 06 10 00 - Rough Carpentry.
F. Division 9 for non-load bearing studs of 20 gauge (33 mil) or lighter.

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.
2. AISI S200 - North American Standard for Cold-Formed Steel Framing - General Provisions.
3. AISI S202 - North American Standard for Cold-Formed Steel Structural Framing.
4. AISI S211 - North American Standard for Cold-Formed Steel Framing - Wall Stud Design.
5. AISI S212 - North American Standard for Cold-Formed Steel Framing - Header Design.
6. AISI S213 - North American Standard for Cold-Formed Steel Framing - Lateral Design.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
9. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members.
11. AWCI - Association of Wall and Ceiling Industries.
12. AWS D1.3 - Structural Welding Code - Sheet Steel.
13. SSMA - Steel Stud Manufacturers Association.

1.4 TESTING AND INSPECTION

A. Special Inspection and Testing:

1. In accordance with Chapter 17 of the International Building Code, the Owner shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704.0.

2. Refer to architectural, civil, mechanical, and electrical specifications for testing and inspection requirements of non-structural components.

3. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected per the table below. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specification to the building official and the Architect and Engineer of Record.

4. Duties of the Special Inspection Agency:
   a. Perform all testing and inspection required per approved testing and inspection program.
   b. Furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work.
   c. Submit a final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge in conformance with the approved plans and specifications.

1.5 QUALITY ASSURANCE

A. Workmen Qualifications:

1. For the actual erection of cold-formed steel framing system, use only skilled journeymen steel framing erectors who are thoroughly experienced with the materials and methods specified.

2. Use qualified welders and comply with AWS standards.

B. Manufacturer: Company specializing in performing the work of this section with a minimum of five (5) years documented experience at manufacturing cold-formed steel and framing systems and related accessories. Manufacturer shall be a current and “full” member of the Steel Stud Manufacturers Association (SSMA) or Steel Framing Industry Association (SFIA).

C. All cold-formed steel furnished under this section shall be supplier by a manufacturer who is a current member of the Steel Stud Manufacturers Association (SSMA) or Steel Framing Industry Association (SFIA).
D. Steel studs and other elements used for this project are sized based on SSMA. Elements of equal or greater capacity may be exchanged.

1.6 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance:
   1. Provide CFSF capable of withstanding design loads indicated on the plans.
   2. Design CFSF to withstand design loads meeting the following deflection limits:
      a. Exterior walls backing up brick or stone veneer: Horizontal deflection of 1/600 of wall height.
   3. Design CFSF to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120°F.
   4. Design system to accommodate construction tolerances, deflection of building structural members (1-inch maximum), and clearances of intended openings.
   5. CFSF shall be designed in accordance with all AISI Standards.

1.7 SUBMITTALS

A. Shop Drawings:
   1. Prepare and submit complete erection and detailed shop drawings for Engineer's approval, including framing plans indicating size, gauge, weight and location of all framing members. Shop drawings shall indicate the following:
      a. Component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, bracing, bridging, strapping, connections, and accessories or items required of other related work. Provide stud layout.
      b. Describe method for securing studs to tracks and for bolted/welded framing connections.
      c. Provide calculations for loadings and stresses of steel framing system, including specially fabricated components, prepared by a registered Professional Engineer, with registration from the state in which the building is located.
      d. Detail size and location of all bridging, strapping, bracing, splices, and accessories required for installation.

B. Product Data:
   1. Provide product data on standard framing members. Describe materials and finish, product criteria and limitations. Submit manufacturer's installation instructions.
C. LEED Certification: Submit manufacturer’s certification for each steel product including the following:

1. LEED Credit MRc 5.1/5.2 – Location of manufacturing plant, manufacturer’s name, product cost and location of extraction or harvest of raw materials.

1.8 DELIVERY, STORAGE AND HANDLING

A. Steel members shall be transported, stored and erected in a manner that will avoid any damage or deformation. Bent or deformed members will be rejected and shall be replaced or repaired at the expense of the responsible party. Store clear of ground and in such a manner so as to eliminate excessive handling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Framing Materials:

1. Studs shall conform to the ASTM designations listed in the General Notes of the drawings, unless noted otherwise, and be formed to channel shape, punched web, with nominal size as indicated on drawings.

2. Track shall be minimum 18 gauge (43 mil) thick sheet steel, channel shaped, solid web, same width as above studs. Track shall provide a tight fit for studs.

B. Accessories:

1. Bracing, furring and bridging shall consist of formed sheet steel with thickness determined for conditions encountered. Provide manufacturer’s standard shapes, complete with finish same as framing members.

2. Plates, gussets and clips shall consist of formed sheet steel with thickness determined for conditions encountered. Provide manufacturer’s standard shapes, complete with finish same as framing members.

C. Fasteners:

1. Self-drilling, self-tapping screws, bolts nuts and washers shall conform to ASTM A90, complete with hot-dip galvanized minimum size: 1/4-14.

2. Expansion anchors shall be “Kwik” bolts, as manufactured by Hilti, Inc.

3. All other fasteners shall be as indicated on drawings or as recommended by the above cold-form manufacturer.

4. Welding connections are to be performed in accordance with American Welding Society (AWS) D1.3 “Structural Welding Code - Sheet Steel.” Consult AWS D19.0 latest edition “Welding Zinc Coated Sheet” and ANSI Standard Z49.1 for information regarding welding procedures.

D. Finishes:

1. Furnish all studs system components with a factory galvanized (G60).
2.2 FABRICATION
A. Fabricate assemblies of framed sections, of sizes and profiles required with framing members fitted, reinforced and braced to suit design requirements.
B. Fit and assemble in largest practical sections for delivery to Worksite, ready for installation.
C. Bearing studs must be fabricated with full stud end seated against track web. Do not use studs that have been cut at punchouts.

2.3 LEED CREDIT
A. LEED Credit MRc 5.1/5.2:
   1. Steel products shall be manufactured within 500 miles of project site. Recycled scrap products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION
3.1 INSPECTION
A. Verify that substrate surfaces and building framing components are ready to receive work.
B. Beginning of installation means acceptance of existing conditions and substrate.

3.2 INSTALLATION
A. General:
   1. Cold-formed steel framing system shall consist of structural steel studs and with locations as shown on drawings. All work shall be in accordance with approved shop drawings and manufacturer's latest printed specifications. Framing members shall be securely attached by mechanical fasteners as indicated on drawings and as recommended by the manufacturer.
      a. All field welding shall be in accordance with AWS previously cited.
      b. Wire tying of stud or components in system will not be allowed.
      c. Complete framing system ready to receive subsequent facing material.
   2. Provision shall be made in studs for rigid fastening of all blocking and special braces or framing and for attachment and support of electrical outlets or other equipment indicated to be supported by stud construction.
      a. All anchorage, bracing and blocking shall be in accordance with approved shop drawings and as recommended by the manufacturer.
   3. Surfaces abraded by handling, weld locations and other miscellaneous defects shall be touched-up with zinc-rich galvanizing compound (ZRC) coating.

B. Erection of Studding:
   1. Top and bottom runner members shall be the same size and gauge as the stud and be continuous for the total length of framing system or as long as practical and shall be securely attached a maximum of 24 inches on centers with approved
fastening devices. Studs shall extend in one-piece full height vertically between runners, spaced no greater than 24 inches on centers, with all web cut-outs in perfect alignment. Studs shall provide solid backing at corners and jambs. Install studs with all components property aligned and braced with all work plumb and true ready and acceptable to receive surface materials.

a. Coordinate installation of sealant with floor and ceiling tracks.
b. Field cutting of studs shall be done by sawing.
c. Splices in axial load studs will not be permitted.
d. Erect load bearing studs, brace and reinforce to develop full strength to meet design requirements.
e. Extend stud framing through ceiling to underside of floor or roof structure above.
f. Install intermediate studs above and below openings with studs equally spaced to correspond to adjacent stud spacing.
g. Provide deflection allowance in stud track, directly below horizontal building framing for non-load bearing framing.
h. Framing fabricator shall ensure punchout alignment when assembling framing and field cutting to length.
i. All framing components shall be cut squarely for attachment to perpendicular members.
j. In the event a track butt joint occurs within a panel, abutting pieces of track shall be butt welded or spliced together. No such splices shall occur at any head or sill condition.

2. Steel studs shall be located not more than 2 inches from all door, abutting partitions, partition corners and other construction. Unless detailed otherwise, runner track or stud member shall be used as a runner over door frames. Structural studs and joists shall be securely and rigidly anchored in place to give a total and complete support to subsequent materials attached thereto. All studs shall be securely attached to jamb and head anchor clips of each door frame by manufacturer's recommended method.

a. Construct corners using minimum three studs. Jamb studs at doors, windows, and other wall openings shall be designed to resist the tributary load of the opening and meet specified performance requirements.
b. Cold-rolled steel channel stiffeners or bridging shall be provided and installed horizontally every 60 inches in all framing systems through stud web cut-outs with welding clips welded in place at each stud.

END OF SECTION 05 40 00
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Miscellaneous steel framing and supports.
   2. Shelf angles.
   3. Loose bearing and leveling plates.
   4. Steel weld plates and angles.
   5. Miscellaneous steel trim.
   6. Metal ladders.
   7. Loose steel lintels.
   8. Metal bollards.

B. See Division 01 Section “Sustainable Design Requirements” for LEED information.

C. See Division 05 Section "Metal Railings" for metal railings.

1.2 REFERENCE STANDARDS

K. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.
1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers’ written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.6 SUBMITTALS

A. Product Data: For the following:
   1. Grout.
   2. Paint products.

B. Shop Drawings: Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   1. Templates: For anchors and bolts.

C. Samples: For each type and finish of extruded nosing and tread.

1.7 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.
PART 2 - PRODUCTS

2.1 RECYCLED CONTENT
A. Products specified in this section contribute to the project-wide requirements for Recycled Content described in Section 0 81 13.14 “Sustainable Design Requirements”.

2.2 MANUFACTURERS
A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.3 METALS
A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.
B. Ferrous Metals:
   1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   2. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 or 316L.
   3. Steel Tubing: ASTM A 500, cold-formed steel tubing.
   4. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
   5. Slotted Channel Framing: Cold-formed metal channels complying with MFMA-3, 1-5/8 by 1-5/8 inches. Channels made from galvanized steel complying with ASTM A 653/A 653M, structural steel, Grade 33, with G90 coating; 0.079-inch nominal thickness.
   6. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
C. Nonferrous Metals:
   3. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.4 FASTENERS
A. General: Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
B. Cast-in-Place Anchors in Concrete: Threaded or wedge type; 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, hot-dip galvanized per ASTM A 153/A 153M.

2.5 METAL BOLLARDS
A. General
   1. Material: Schedule 40 steel pipe
   3. Fill bollards solidly with concrete.
B. Bollard covers:
1. Products: Plastic bollard cover as manufactured by Ideal Shield.
4. Size: Coordinate diameter and height with steel bollards.
5. Locations: Provide at all concrete-filled metal bollards.

2.6 PERFORATED METAL PLATE VERTICAL SUNSHADES

A. General:
1. Location(s)
   a. East curtain wall windows of Report Room.
4. Finish:
   a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
   b. Color: As selected by Architect from manufacturer's full range.

B. Perforations:
1. Perforation pattern to be determined by Architect, and shall be fully custom, including custom shape(s), pattern, spacing, etc. Standard hole patterns will not be accepted.
2. Architect will provide fabricator with CAD file for water and/or laser cutting. Cutting type shall be determined by ability to provide the cleanest and most accurate cut.

2.7 ALUMINUM PLATE HORIZONTAL SUNSHADES

A. General:
1. Location(s):
   a. South curtain wall windows of Kitchen, Dining and Day Room.
3. Thickness: 1/2-inch.
4. Finish:
   a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
   b. Color: As selected by Architect from manufacturer's full range.

2.8 SWIVEL ANCHOR

A. General:
1. Location(s):
   a. Apparatus Bay mezzanine training openings.
2. Basis of Design: Swivel Anchor Point (10K) as manufactured by Malta Dynamics, model A7400.
3. Attachment: Bolt to bent plate.

2.9 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI #79.

B. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
1. Available Products:
b. Carboline Company; Carbozinc 621.
c. ICI Devoe Coatings; Catha-Coat 313.
f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.

C. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for regalvanizing welds in steel.


E. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.10 FABRICATION

A. General: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
4. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
5. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 24 inches o.c.

B. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work. Fabricate units from steel shapes, plates, and bars of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.

C. Loose Steel Lintels: Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
1. Lintels in Exterior Walls: Hot-dip galvanize.

D. Shelf Angles: Fabricate shelf angles of sizes indicated and for attachment to framing. Fabricate with horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c.
1. Shelf Angles in Exterior Walls: Hot-dip galvanize.
2. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

E. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts.

F. Miscellaneous Steel Trim: Fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed
field splices where possible. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Exterior Miscellaneous Steel Trim: Galvanize.

G. Metal Access Ladders:
2. Stringers (Siderails) 2 \( \frac{1}{2} \) inches X \( \frac{1}{2} \) -inch flat bar. Provide 3-inch outward return at base and anchor to floor with expansion anchor. Space siderails 18 inches apart, unless otherwise indicated.
3. Mounting Brackets: 8-\( \frac{1}{2} \)" X 4-\( \frac{1}{2} \)" X 3" X \( \frac{1}{4} \)" steel angle welded to siderail and ground smooth. Provide one set of anchors 18" from top and bottom and no more than 4 feet apart.
4. Ladder Rungs:
   a. Material: 3/4-inch diameter steel bar rungs fitted in centerline of siderails, plug-welded, and ground smooth on outer rail faces.
   b. Space first ladder rung 12-inches from floor surface. Subsequent rungs shall be spaced 12-inches apart.
   c. Provide high traction ladder rung cover for each ladder rung.
      1) Shape: half-round
      2) Fastening: mechanically fasten and adhere
      3) Texture grade: as selected by Architect from manufacturer’s standard range.
   d. Provide knurled surface to top sides of rungs for increased bonding by high traction ladder rung cover adhesive.
5. Finish: Paint exposed metal portions of ladder gloss black with epoxy paint prior to installing high traction ladder rung safety covers. Do not paint top surfaces of rungs where high traction ladder rung safety covers are to be installed.

2.11 FINISHES

A. Comply with NAAMM’s "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal fabrications after assembly.

B. Steel and Iron Finishes:
1. Hot-dip galvanize items as indicated to comply with ASTM A 123/A 123M or ASTM A 153/A 153M as applicable.
2. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below for environmental exposure conditions of installed metal fabrications:
   a. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   b. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
3. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting," for shop painting.
4. Contractor Option to provide Tnemec Finish in lieu of galvanized as follows:
   a. Surface Prep: SSPC SP 6 Commercial Blast Cleaning
   b. Primer: Tnemec Series 90-97 Tnemec Zinc at 2.5-3. 5mils DFT
   c. Finish: Tnemec Series 27 Typoxy at 3-4 mils DFT
PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.
   1. Fit exposed connections accurately together. Weld connections that are not to be left as exposed joints but cannot be shop welded. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication.
   2. Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
   3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack solidly with nonshrink, nonmetallic grout.

C. Grind all welds to be smooth, uniform, clean and of architectural grade appearance to meet NOMMA Finish #1.

D. Touch up surfaces and finishes after erection.
   1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.
   2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.2 INSTALLING METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inch (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Fill bollards solidly with concrete.

END OF SECTION 05 50 00
SECTION 05 51 00
METAL STAIRS AND RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Steel stairs with concrete-filled treads.
   2. Steel pipe railing.

B. Related Sections:
   1. Section 05 50 00 – METAL FABRICATIONS

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Uniform Load: 100 lbf/sq. ft.
   2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
   3. Uniform and concentrated loads need not be assumed to act concurrently.
   4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
   5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

B. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.

   2. Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.

   3. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
      b. Uniform load of 25 lbf/sq. ft. applied horizontally.
      c. Infill load and other loads need not be assumed to act concurrently.

1.3 SUBMITTALS

A. Product Data: For metal stairs.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1.4 LEED SUBMITTALS
   A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.5 COORDINATION
   A. 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.
   B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 RECYCLED CONTENT
   A. Products specified in this section contribute to the project-wide requirements for Recycled Content described in Section 0 81 13.14 “Sustainable Design Requirements”.

2.2 METALS
   A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.
   B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   C. Steel Tubing: ASTM A 500 (cold formed), Grade B.
   D. 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.
   E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25.
   F. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30.

2.3 MISCELLANEOUS MATERIALS
   A. Fasteners: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls.
   B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
   C. Concrete Materials and Properties: Comply with requirements in Division 03 Section “Cast-in-Place Concrete” for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
   D. Welded Wire Fabric: ASTM A 185, 6 by 6 inches--W1.4 by W1.4, unless otherwise indicated.
E. Grout and Anchoring Cement: Factory-packaged, nonshrink, nonmetallic grout complying with ASTM C 1107; or water-resistant, nonshrink anchoring cement; recommended by manufacturer for exterior use.

2.4 FABRICATION

A. Available Fabricators:
   1. Alfab, Inc.
   2. American Stair, Inc.
   3. Sharon Companies Ltd. (The).
   4. Other fabricators as approved by Architect.

B. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
   1. Join components by welding, unless otherwise indicated. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed connections, finish exposed welds smooth and blended.
   2. Use connections that maintain structural value of joined pieces.
   3. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
   4. Form bent-metal corners to smallest radius possible without impairing work.
   5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

C. Stair Framing: Fabricate stringers of steel shapes as indicated on drawings. Construct landing platforms of steel members as indicated on drawings, and include miscellaneous framing members as needed to provide full and complete framing assembly. See drawings for sizes and configurations.
   1. If using bolts or fasteners, fabricate and join so bolts are not exposed on finished surfaces, and are recessed below surface of exposed framing components. After installation, Bondo, sand and smooth over heads of bolts and/or fasteners to provide a smooth, seamless surface prior to painting.
   2. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

D. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements.

2.5 GUARDRAILS

A. Guardrails:
   1. Member sizes:
      a. Vertical post size: 1-1/2” outside diameter, 1/4" wall thickness.
      b. Horizontal top rail size: 1-1/2” outside diameter, 1/4" wall thickness.
      c. Other member sizes as noted on drawings.
2.6  HANDRAILS

A. Handrails:
   1. Diameter: 1-1/2” outside diameter, 1/4” wall thickness.
   3. Handrail brackets: RB34125.4 as manufactured by Wagner:
      a. Profile: Bent Bar
      b. Bar Diameter: 5/8” diameter
      c. Projection: 2-1/2”
      d. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

2.7  FINISHES

A. Comply with NAAMM’s "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal stairs after assembly.

B. Hot-dip galvanize items indicated to be galvanized. Comply with ASTM A 123/A 123M or ASTM A 153/A 153M as applicable.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below for environmental exposure conditions of installed products:
   1. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."


2.8  ACCESSORIES

A. Abrasive Tread Insert
   1. Basis of Design: Photoluminescent Insert Ribbed Bar Abrasive Nosing as manufactured by Babcock-Davis
      a. Model: BSTSB-N1.375D
         1) Base: Heat treated extruded aluminum Alloy 6063 T-5
         2) Abrasive: Aluminum-oxide silicon carbide granules in a UV protected, 2-part epoxy, locked into extruded channels
         3) Base Finish: Mill.
         4) Length: Nosing shall be full length of step, less 1/8” clearance.
         5) Color: Luminescent.
         6) Mounting: Pre-drilled countersunk holes for a #10 fastener space 3” from ends and no more than 12-inches apart. Space fasteners evenly between stringers.

PART 3 - EXECUTION

3.1  INSTALLATION OF STAIRS

A. Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

B. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.
C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints. 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.

D. Grind all welds to be smooth, uniform, clean and of architectural grade appearance to meet NOMMA Finish #1.
   1. Bondo and skim-coat all exposed metal surfaces as needed to provide specified appearance and finish prior to painting.
   2. Architect will provide final approval of welded and dressed connections prior to painting.

E. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."
   1. Concrete surface shall be flat and level.
   2. Provide light broom finish.

F. Adjusting and Cleaning:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting.
   2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.2 INSTALLATION OF GUARDRAILS AND HANDRAILS

A. General: Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation.
   1. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Locations: Provide at locations indicated on drawings, and at the following locations:
   1. Provide handrails at all stairs, each side of stair.

C. Install handrail at height of 34 – 38 inches above ramp surface or stair tread nosings, measured from ramp surface or tread nosing to top of handrail.

D. All handrails to return to adjacent wall, guardrail or other surface. If not specifically shown on drawings, manufacturer to verify where handrails return with Architect prior to fabrication.

E. Ensure 1-1/2” minimum clearance between inside face of handrail and nearest adjacent surface including, but not limited to, wall or guardrail support post.

F. Welding of components:
   1. Continuously weld all guardrail components on all exposed edges and at non-exposed areas needed to meet or exceed structural requirements.
   2. Fill all scratches, scuffs, mars, etc in exposed surfaces of guardrail components with body putty and sanded smooth prior to painting.
   3. Grind all welds to be smooth, uniform, clean and of architectural grade appearance to meet NOMMA Finish #1.
      a. Bondo and skim-coat all exposed metal surfaces as needed to provide specified appearance and finish prior to painting.
      b. Architect will provide final approval of welded and dressed connections prior to painting.
G. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

H. Secure wall brackets to building construction as indicated, or if not indicated, as follows:
   1. Where anchoring into CMU, grout cells at attachment point solid. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. Provide blocking between studs in stud wall construction, if applicable.

I. Adjusting and Cleaning:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting.
   2. Clean all guardrail components prior to and after painting.
   3. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
   4. Stainless steel railings:
      a. Where stainless steel handrails are welded in field, grind welds smooth, taking care not to remove too much material as to indent or deform handrail.
      b. Dress and buff all welds so welded connections appear as part of factory formed railing and welds/connections are not apparent by either touch or sight.

3.3 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion. It is the contractor's responsibility to correct, either by repairing or replacing, any and all damage sustained to the railings during construction.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION 05 51 00
SECTION 06 10 00
ROUGH CARPENTRY

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. Wood blocking, cants, and nailers.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Composite wood products shall be documented to have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins as described in Section 01 81 13.14 “Sustainable Design Requirements”.

B. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
2.3  **WOOD-PRESERVATIVE-TREATED MATERIALS**

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.4  **FIRE-RETARDANT-TREATED MATERIALS**

A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Treatment not to promote corrosion of metal fasteners.
   2. Exterior Type: Comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Interior Type A: Moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   4. Design Value Adjustment Factors: Test according to ASTM D 5664 and calculate design value adjustment factors according to ASTM D 6841.

B. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

C. For exposed items indicated to receive a stained or natural finish, chemical formulations not to bleed through, contain colorants, or otherwise adversely affect finishes.

D. Plywood backing panels for interior partition walls
   1. Contractor option to use Danback Flexible Wood Backing System with fire-retardant treated wood (FRT) as manufactured by Clark Dietrich.

2.5  **DIMENSION LUMBER**

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Structural Framing: Number 2 or better Douglas Fir –or- Hem Fir.

C. Non-structural Uses: Number 2 or better Spruce-Pine-Fir
2.6 MISCELLANEOUS LUMBER

A. General: Provide lumber required for support or attachment of other construction, including the following:
   1. Wall framing.
   2. Blocking.
   3. Cants.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content.

C. Wood blocking under fully adhered membranes: Untreated Douglas Fir No. 2. Protect blocking with poly cover prior to membrane installation. Blocking must be within allowed moisture content.

D. For furring strips if indicated on Drawings, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.7 SURFACE-MOUNTED PLYWOOD PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

B. Provide plywood backing panels at all electrical and data rooms, from 6-inches above finished floor to 8'-6" above finished floor.

C. Paint all exposed plywood backing panels with project field color paint after installation. Refer to Drawings for more information.

2.8 FASTENERS

A. General: Provide fasteners of size and type that comply with requirements specified in this Article for material and manufacture.
   2. Where rough carpentry is exposed to weather, in ground contact, in area of high relative humidity, or preservative treated, provide fasteners with hot-dip zinc coating complying with ASTM A 153 Class D.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers, galvanized per ASTM A153.
H. Anchor Bolts:
1. Adhesive Type
   a. Anchor Rods:
      1) Carbon Steel for Interior Applications: Compliant with ASTM A307
      2) Stainless Steel for Exterior Wall Applications, when in contact with Pressure Treated Lumber: Type 304 Stainless Steel compliant with ASTM F593.

   b. Nuts:
      1) Carbon Steel for Interior Applications: Compliant with ASTM A563, Grade A
      2) Stainless Steel for Exterior Wall Applications, when in contact with Pressure Treated Lumber: Type 304 Stainless Steel compliant with ASTM F594.

   c. Washers
      1) Carbon Steel for Interior Applications: Compliant with ANSI B18.22.1, Type A
      2) Stainless Steel for Exterior Wall Applications, when in contact with Pressure Treated Lumber: Type 304 Stainless Steel compliant with ASTM 240.

   d. Adhesive
      1) Compliant with ASTM C881, Type I to IV, Grade 3, Class B or C.

   e. Acceptable manufacturers and products:
      1) Hilti Fastening System   HIT HY200
      2) Power Fastening Inc.  Power-Fast,
      3) ITW Ramset/Red Head  Epcon C6 Anchors

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, and similar supports to comply with requirements for attaching other construction.

   B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

   C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

   D. Securely attach rough carpentry work to substrate by anchoring and fastening as required.

   E. Use common wire 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; predrill as required.

   F. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler. Indicate locations of other fasteners, such as wood screws, bolts, and lag screws, on Drawings.
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. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

C. Besides as required for the installation of other items, Contractor shall install full and complete wood blocking within stud walls behind the following:
   1. Millwork attachment.
   2. Grab bar attachment.
   3. Door bumpers.
   4. Wall and ceiling-mounted equipment.
   5. Owner-provided equipment; contractor shall review all owner-provided/contractor-installed and owner-provided/owner-installed item locations with Owner and provide wood blocking/backing as required.

3.3 WOOD STRUCTURAL PANEL INSTALLATION


END OF SECTION 06 10 00
SECTION 06 16 00
SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Wood and gypsum-based wall sheathing.

1.2 RELATED SECTIONS

A. Section 05 40 00 - Cold-Formed Metal Framing
B. Section 06 10 00 - Rough Carpentry
C. Section 09 29 00 - Gypsum Board

1.3 REFERENCES

A. ASTM International (ASTM):
   3. ASTM C1002 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.


1.4 WARRANTY

A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay) commencing with the date of installation of the product in such structure.

B. Manufacturer’s Warranty:
   1. Five years against manufacturing defects from the date of purchase of the product for installation.
1.5 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 and fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.

B. Research/Evaluation Reports: For the following:
   1. Preservative-treated plywood.
   2. Fire-retardant-treated plywood.

1.6 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.7 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Composite wood products shall be documented to have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins as described in Section 01 81 13.14 “Sustainable Design Requirements”.

B. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

2.3 PRESERVATIVE-TREATED PLYWOOD


B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.
2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Comply with performance requirements in AWPA C27.
   1. Use Exterior type for all exterior locations and where indicated.
   2. Use Interior Type A, High Temperature (HT) for roof sheathing and where indicated.
   3. Use Interior Type A at all interior locations requiring wood sheathing, unless otherwise indicated.

B. Kiln-dry material after treatment to a maximum moisture content of 15 percent.

C. Identify fire-retardant-treated plywood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Application: Treat plywood indicated on Drawings.

2.5 EXTERIOR WALL SHEATHING

A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing.

B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

C. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
   1. Type and Thickness: Regular, 5/8-inch thick
   2. Products:
      b. GlasRoc by CertainTeed.
      c. Securock by USG.
      d. E2EXP Extended Exposure Sheathing by National Gypsum.
   3. Provide 5/8-inch thick, Type X wall sheathing at the exterior wall within 4 feet, either side, of the fire wall separation joint, if applicable.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated.
   1. For wall and roof sheathing panels, provide fasteners with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use indicated by manufacturers of both adhesives and panels.
   1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Securely attach to substrate by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
5. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."
6. 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."
7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One- and Two-Family Dwelling Code."

B. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that exclude exterior moisture.

C. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION


B. Fastening Methods: Fasten panels as indicated below:
   1. Wall Sheathing:
      a. Screw to cold-formed metal framing.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum 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.

END OF SECTION 06 16 00
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Bamboo Plywood cabinets.
   2. Solid-surfacing-material countertops.
   4. Quartz countertops
   5. Display Cabinet

B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips unless concealed within other construction before woodwork installation.

C. Related Sections: Section 01 81 13.14 “Sustainable Design Requirements”.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated including solid-surfacing material, cabinet hardware and accessories, handrail brackets and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples:
   2. Solid-surfacing materials.
   3. Quartz materials.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer (5 years minimum) who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Fabricator Qualifications: A firm experienced (5 years minimum) 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.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards".
1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
   2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish 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 established dimensions.

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Composite wood products shall be documented to have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins as described in Section 01 81 13.14 “Sustainable Design Requirements”.

B. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 MATERIAL OPTIMIZATION

A. Manufacturer materials for bamboo plywood, and solid surfacing specified in this section has been identified to have a published Environmental Product Data (EPD) Declaration and/or a published Material Ingredient (HPD+). Project-wide requirements are described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.3 MATERIALS

A. Wood Products:
   1. Medium-Density Fiberboard: ANSI A208.2, Grade MD.

B. Bamboo Plywood Basis of Design: PlyBoo Strand
   1. Manufacturer: Smith & Fong Company, San Francisco, CA 94103
      a. Tel: (866) 835-9859
      b. E-mail: sales@plyboo.com
      c. Website: www.plyboo.com
   2. Species: Moso (Phyllostachys Pubescens)
   3. Type: 3/4 inch thick, 3-ply
   4. Color: Havana Strand
5. Accessories
   a. Edge Banding, 3/16 inch (4mm) thick by 30 inches wide by 72 inches in length.
   b. Color: Havana Strand

   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Avonite, Inc.
      b. Corian by DuPont
      c. LG Hausys America – HI-MACS
      d. Meganite Inc.; a division of the Pyrochem Group.
      e. Wilsonart International; Div. of Premark International, Inc.

D. Quartz Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
   1. Manufacturers: See finish schedule product.

E. Stainless Steel Filler Panel: Provide .027” stainless steel filler panel for cabinets in sizes and locations as shown on Drawings.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use Exterior Type or Interior Type A. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Kiln-dry material after treatment.

B. Fire-Retardant Particleboard: Panels made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture with flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

C. Fire-Retardant Fiberboard: ANSI A208.2 medium-density fiberboard panels made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture with flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

D. Provide Fire-retardant materials only where required to maintain code compliance.

2.1 DISPLAY CABINET

A. Surface-Mounted Cabinet: Shop-fabricated cabinet with tack assembly on back inside surface and glazed door at front.
   1. Cabinet Box: See drawings.
   2. Cabinet Frame: See drawings.

B. Glazed Sliding Doors: Tempered glass; unframed; with extruded-aluminum top and bottom track; supported on nylon or ball-bearing rollers; with plastic top guide and rubber bumpers. Equip each door with ground finger pull and adjustable cylinder lock with two keys.
   1. Thickness: Not less than ¼” thick.
   2. Number of Doors: Two per unit.
C. Shelves: ¼” thick tempered glass; supported on adjustable shelf standards and supports.
1. Shelf Width: See drawings.
2. Number of Shelves: As indicated on Drawings.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071. Provide standards full height of display case.

1. Color: As selected by Architect from manufacturer's full range.

2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095-inch thick metal, and as follows:
1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, institutional quality. 1-1/2 pair for doors 20-40 lbs or 3-5 feet high. 2 pair for doors 40-60 lbs or 5-7 feet high, manufactured by Grass America Inc.

D. Back-Mounted Pulls: BHMA A156.9, B02011.
1. Basis of Design: Hafele; Tab Collection, Satin Aluminum, 6” length

E. Catches: Magnetic catches, BHMA A156.9, B03141.

F. Drawer Slides: BHMA A156.9, B05091.
1. Standard Duty (Grade 1, Grade 2, and Grade 3): Side mounted; full-extension type; zinc-plated steel with polymer rollers. 75 pound capacity for drawers less than 18” wide.
   a. Accuride #3800
   b. Knafe & Vogt #8300
2. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides. 100 pound capacity for drawers 18” or wider.
   a. Accuride #4037
   b. Knafe & Vogt #8500
   c. Grass #6610
3. Box Drawer Slides: Grade 1; for drawers not more than 6 inches high and 24 inches wide.
4. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.

G. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.

H. Adjustable shelving:
1. Standards = in all locations at 32" o.c. minimum spacing KV87wH-96”.
2. Brackets = KV187WH-24” with KV211 cups front and back of each bracket with KV129 rubber cushions.
3. Shelving: Plastic Laminate on both sides of ¾” particle board with 3 mm pvc edges all edges. 24” deep – typical, by full length – see drawings.
4. Locations:
a. See Drawings.

I. Grommets:
   1. 2-1/2" diameter, black plastic. Provided by millwork vendor, contractor installed.
      a. Provide at all counters with knee space below. Coordinate locations with owner.
         Install (1) every 5 feet of open counter.

J. Door Locks: BHMA A156.11, E07121. Where indicated equivalent to Knape & Vogt #987.

K. Drawer Locks: BHMA A156.11, E07041. Where indicated equivalent to Knape & Vogt #987.

L. Chain Stops: Provide on all hinged doors adjacent to cabinets or countertops of greater depth,
   or adjacent to walls. Chain stops to stop contact between door and door pull and any adjacent
   surfaces.
   1. Product: Ives No. 88 Transom Chain or equivalent.

M. Shelf Rests (for drilled holes): Steel with satin chrome finish.
   1. Shelf pins = bright chrome for 5mm or ¼" hole.

N. Neoprene door/drawer bumpers: ANSI A156.16, L03021, color black or clear transparent.
   Provide at each door/drawer condition.

O. Knee braces a.k.a. counter top supports:
   1. Bracket = Hafele “Hebgo” bracket
      a. At 30" deep counter tops = provide Hafele 287.45.486 – 28" brackets.
      b. At 25" deep counter tops = Hafele 287.45.477 – 23" brackets.
   2. Finish = paint to match wall
   3. Provide at all counter tops with knee space below, at 32" o.c. typical.

P. Wire management: WM-2A Plastic system by Doug Mockett or equal. Install between all
   counter top brackets typical and under counter tops that require grommets and counter top
   brackets.
   1. Provide in all locations that require grommets

Q. Coat hooks: Peter Pepper 2083AL with door stop tip.
   1. Provide at the following locations: All office doors and bunk rooms.

R. Metal Coat Rod Holder and Coat Rod:
   Provide on underside of shelf unit.
   1. Satin Chrome plated heavy duty metal wall flanges.
   2. 1-1/2" inch diameter bright chrome rod.
   3. Provide at Corridor 117

S. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with
   BHMA A156.18 for BHMA finish number indicated.
   1. Dark, Oxidized, Satin Bronze, Oil Rubbed: BHMA 613 for bronze base; BHMA 640 for
      steel base; match Architect's sample.
   2. Bright Brass, Clear Coated: BHMA 605 for brass base; BHMA 632 for steel base.
   3. Bright Chromium Plated: BHMA 625 for brass or bronze base; BHMA 651 for steel base.

T. Furniture Leg:
   1. Basis of Design: Hafele, Square, Steel, 634.13.021
   2. Finish: Brushed Stainless
3. Height: 10”
4. See drawing for locations.

U. Concealed Bracket:
   1. Basis of Design: Federal Brace Hidden Countertop Brackets
   2. Finish: White
   3. See Drawings for locations.

V. Solid Surface sink bowl: Corian 820 bathroom sink-white:
   1. See drawings for locations
   2. Prefabricated shop installed by millwork vendor.

W. Quartz countertop: See Finish schedule for product and locations.

2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, fire-retardant-treated, kiln-dried to less than 15 percent moisture content.

2.4 FABRICATION

A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
   1. Interior Woodwork Grade: Custom.
   2. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish.
   3. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA’s "Glazing Manual." For glass in wood frames, secure glass with removable stops.

B. Bamboo Plywood Cabinets for Transparent Finish:
   1. AWI Type of Cabinet Construction: Flush overlay.
   2. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
   5. Semiexposed Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
   8. Provide dust panels of 1/4-inch bamboo plywood above compartments and drawers, unless located directly under tops.

C. Solid-Surfacing-Material and Quartz Countertops:
   2. Colors, Patterns, and Finishes: See Finish Schedule
   3. Fabricate tops in one piece with shop-applied backsplashes. Comply with solid-surfacing-material manufacturer’s written recommendations for adhesives, sealers, fabrication, and finishing.
   4. Install integral sink bowls in countertops in shop.

2.5 SHOP FINISHING

A. Finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
B. Transparent Finish:
   1. Grade: Custom.
   2. AWI Finish System: Conversion varnish.
   3. Staining: Match approved sample for color.
   4. Wash Coat for Stained Finish: Apply a wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
   5. Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
   6. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 INSTALLATION

   A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas. Examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

   B. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

   C. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches. Shim as required with concealed shims.

   D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

   E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

   F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
   1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.

   G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

END OF SECTION 06 40 23
SECTION 06 64 00  
PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

1.2 SUBMITTALS
A. Product Data: For each type of product indicated.

1.3 LEED SUBMITTALS
A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 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. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

PART 2 - PRODUCTS

2.1 AIR QUALITY
A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 PLASTIC SHEET PANELING
A. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Marlite FRP panels, USDA approved for incidental food contact or comparable product by one of the following:
      a. Crane Composites (Kemlite)
      b. Nudo Products, Inc.
      c. Substitutions: allowed in accordance with Division 1 Specifications.
   3. Width: 48”.
   4. Height: 96”
   5. Surface Finish: gently pebbled, high-gloss
   6. Color: As selected by Architect from manufacturer’s full range.
2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece PVC extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, caps and base molding as needed to conceal edges.
   1. Color: As selected by Architect from manufacturer's full range.

B. Adhesive: As recommended by plastic paneling manufacturer and complying with requirements of Part 1 of this Section.

C. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section “Joint Sealants” and Part 1 of this Section.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.

B. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

C. Lay out paneling before installing. Locate panel joints where indicated.

3.2 INSTALLATION

A. Locations
   1. Behind and beside mop basins.
      a. Provide 4'-0" wide x 4'-0" tall FRP wall paneling behind and beside mop basin.
   2. Behind roof access hatch ladder.
      a. Provide 2'-6" wide FRP wall paneling behind roof hatch access ladder, to be installed behind siderail supports. Paneling shall be full height of ladder, from floor to roof decking.

B. Install plastic paneling according to manufacturer's written instructions.

C. Install panels in a full spread of adhesive.

D. Install trim accessories with adhesive.

E. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.

F. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 64 00
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Below-grade foundation insulation
   2. Polyisocyanurate board insulation
   4. See Section 09 29 00 for batt (sound) insulation.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include product test and research/evaluation reports.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by 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.

1.5 PERFORMANCE CRITERIA

A. Thermal Resistance Values (R):
   1. Thermal resistance or material thickness shall be as shown on Drawings and scheduled herein.
   2. Indicated “R” shall be for the insulation material by itself per ASHRAE.

B. Fire Hazard Classification: Insulation materials, including integral facing covers, shall meet the following ratings when tested in accordance with ASTM E-84 (tunnel test):
   1. Fuel contributed: 50.
   3. Maximum smoke developed: 450 (50 for insulation left exposed).

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 MATERIAL OPTIMIZATION

A. Products specified in this section have been identified to have a published Environmental Product Data (EPD) Declaration and/or published Material Ingredient (HPD+). Project-wide
requirements are described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.3 BELOW-GRADE FOUNDATION INSULATION

A. Below-Grade Extruded-Polystyrene Board Foundation Insulation: ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Chemical Company “Styrofoam”.
      b. Owens Corning “Foamular XPS”.
      c. Substitutions: Allowed in accordance with Sections 00 26 00 and 01 81 13.14.
   2. Type IV, 25 psi.
   3. Thickness: As indicated on Drawings.

2.4 POLYISOCYANURATE BOARD INSULATION

A. Polyisocyanurate Board, Glass Faced: ASTM C 1289, Type I, Class 1 or 2.
   1. Products:
      a. Basis of Design: Hunter Panels Xci CG.
      b. CCW R2+ Matte Polyiso Insulation Board.
      c. Substitutions: Allowed in accordance with Section 00 26 00.
   2. Properties:
      a. Thickness: See Drawings
      c. At exterior walls, provide Type II, Class 1 or 2, Grade 3, 25 psi minimum compressive strength.

2.5 SPRAY-APPLIED FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: Spray-applied polyurethane foam using water as a blowing agent, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Basis of Design: Icynene Proseal MD-C-200
   2. Thermal Performance: ASTM C518 R/in = 6.6
   3. Burn Characteristics: ASTM E84:
      a. Flame Spread: 25
      b. Smoke Development: 300
   4. Thermal Protection: At applications not otherwise protected by gypsum board or other acceptable thermal protection provide thermal protection barrier as required by code including above-ceiling spaces, plenum spaces and otherwise concealed spaces including soffits, bulkheads and canopies.
      a. Thermal Protection Coating: DC315 Intumescent thermal barrier coating as manufactured by International Fireproof Technology Inc.
      b. See Drawings for locations requiring intumescent paint.
   5. Installation must be by Licensed Dealer and per manufacturer’s recommendations, refer to manufacturer’s written technical data.

2.6 NAILABLE BASE INSULATION BOARD

A. Product:
   2. Thicknesses:
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a. Total thickness: 3.625-inch (nominal) / 3.6-inch (actual)
   • Insulation thickness: 3-inch
b. Total thickness: 2.625-inch (nominal) / 2.6-inch (actual)
   • Insulation thickness: 2-inch

3. Panel assembly: high thermal rigid insulation panel assembly composed of a close cell polyisocyanurate foam core bonded to a glass facer (inboard side) and fire-retardant treated plywood (outboard side).

4. Physical Properties
   a. Compressive Strength: 20 psi min, ASTM D 1621
   b. Dimensional Stability: 2% linear change, ASTM D 2126
   c. Moisture Vapor Permeance: <1 perm, ASTM E 96
   d. Water Absorption: < 0.1% volume, ASTM C 209
   e. Service Temperature: -100° to 250° F
   f. Resistance to Mold: Passes (10), ASTM D 3273

5. Characteristics and Compliance
   a. ASTM C 1289 Type V made with Type II Class 2 foam

B. Fastening:
   1. Install nailable base insulation with manufacturer’s approved fasteners and fastening methods to support nailable base insulation and cladding:
   2. Fastener:
      b. Head Diameter: 0.625-inch, minimum
      c. Thread Diameter: 0.245-inch, minimum
      d. Shank Diameter: 0.212-inch, minimum
      e. Length: 6-inch; minimum 1-inch penetration into metal studs.
   3. Fastener spacing: 16-inches vertical on center / 16-inches horizontal on center. Fasteners must align with and penetrate metal studs.

2.7 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.8 ACCESSORIES

A. Fiberglass angles for door threshold and curtain wall attachment:
   1. Provide fiberglass reinforced plastic (FRP) angles to size(s) indicated on drawings.
   2. Basis of design: EXTREN Series 500, all-purpose fiberglass angles as manufactured by Strongwell Corp.

2.9 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate formed from perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square, welded to projecting copper-coated steel spindle 0.105 inch in diameter and of length capable of holding insulation of thickness indicated securely in position with 1-1/2-inch- square or diameter self-locking washers complying with the following requirements:
   1. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel sheet, with beveled edge for increased stiffness.
   2. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 2 inches between face of insulation and substrate to which anchor is attached.
C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

D. Insulation fastener only required at exterior wall polyisocyanurate board insulation if masonry anchor not used to secure insulation during installation.

PART 3 - EXECUTION

3.1 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.

E. Install in the minimum number of pieces and with the least number of joints possible.

3.2 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
   1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
   1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.3 INSTALLATION OF EXTERIOR WALL INSULATION

A. Installation at masonry cavity walls: Secure insulation with screw-attached masonry veneer anchor being careful not to over-compress insulation board. Contractor may use adhesive to temporarily secure insulation board in place. Tightly fit courses of insulation between and around obstructions, with edges butted tightly in both directions and making full contact with head, jamb and sill plates and penetrating objects. Press units firmly against inside substrates.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION AND IN/AROUND STRUCTURAL MEMBERS
October 15, 2019

A. 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.

B. Spray-Applied Foam Insulation: Apply spray-applied foam insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer. Completely fill all voids in areas to receive spray-applied foam insulation as indicated on drawings.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
   2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

END OF SECTION 07 21 00
SECTION 07 24 14
DIRECT-APPLIED EXTERIOR FINISH SYSTEMS

PART 1 GENERAL

1.1 SUMMARY
A. Textured finish system for exterior gypsum or cement board soffit and ceiling surfaces.

1.2 SUBMITTALS
A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used. Include manufacturer's Material Safety Data Sheets.

1.3 REFERENCES
A. ASTM C1177, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
C. Rule 1113, Architectural Coatings

1.4 QUALITY ASSURANCE
A. Manufacturer's Qualifications: Company with at least thirty five years of experience in manufacturing specialty finishes and regularly engaged in manufacture and marketing of products specified herein. Manufacturer to have ISO 9001:2008 certified quality system and ISO 14001:2004 certified environmental management system.
B. Installer's Qualifications: At least 5 years of experience in commercial textured finish application and completed at least 3 projects of similar size and complexity. Contractor to provide proof before commencement of work that he/she will maintain and supervise qualified crew of applicators through duration of work. When requested Contractor to provide list of last three comparable jobs including name, location, and start and finish dates for work.
C. Mock-ups: Install mock-up of system for evaluation and approval by architect, building owner, or owner’s representative/quality assurance agent.
D. Testing: Conduct as directed by Architect, building owner, or owner’s representative/quality assurance agent to verify soffit/ceiling assembly performance and adhesion to prepared substrates.

1.5 DELIVERY, STORAGE AND HANDLING
A. Deliver products in original packaging, labeled with product identification, manufacturer, and batch number.
B. Store products in a dry area with temperature maintained between 50 and 85 degrees F. Protect from direct sunlight. Protect from freezing. Protect from extreme heat (>90 degrees F).
C. Handle products in accordance with manufacturer’s printed instructions.
1.6 WARRANTY

   A. Provide manufacturer’s standard limited warranty.

PART 2 PRODUCTS

2.1 PRODUCTS

   A. Basis of Design: StoQuik Gold System for Soffits & Ceilings as manufacturer by Sto Corp.

   B. Acceptable alternative manufacturers:
      1. BASF
      2. Dryvit

2.2 MATERIALS

   A. Finish
      2. Color: As selected by Architect from manufacturer’s full range.

   B. Primer
      1. Acrylic-based smooth primer, complies with SCAQMD Rule 1113 for primers

   C. Base Coat
      1. One component polymer modified portland cement extra high build base coat

   D. Surface Reinforcement
      1. Nominal 4.5 oz/yd² (153 g/m²) glass fiber reinforcing mesh treated for compatibility with adjoining materials.

2.3 ACCESSORIES

   A. Edge reveal trim
      1. Provide reveal trim at all outside edges, unless noted otherwise.
         a. Reveal Depth: match thickness of gypsum sheathing and direct applied exterior finish system.
         b. Reveal Width: 1/2-inch.
         c. Finish: Two-coat Kynar finish, custom matched to color of direct-applied exterior finish.

PART 3 EXECUTION

3.1 INSTALLATION

   A. Install gypsum or cement soffit board in conformance with applicable building code and manufacturer’s written installation instructions. Gypsum or cement soffit board surface: Clean, dry, and free of surface contamination. Soffit board surface requirements: no planar irregularities in excess of 1/16 inch and free of voids, cracks, and other surface defects.
   1. Mix products in accordance with published literature. Refer to applicable Product Bulletins for specific information on use, handling, application, precautions, and limitations of specific products.
B. Application
   1. Install all system components in accordance with manufacturer’s written installation guidelines.

C. Protection
   1. Provide protection of installed materials from water infiltration into or behind them during and after construction.
   2. Provide protection of installed materials from dust, dirt, precipitation, freezing and continuous high humidity until they are fully dry.
   3. Seal penetrations through the finished surface with backer rod and sealant or other appropriate means.

END OF SECTION 07 24 14
SECTION 07 27 00
UNDER-SLAB VAPOR BARRIER

PART 1 – GENERAL

1.1 SUMMARY
A. Products Supplied Under This Section
   1. Vapor Barrier, seam tape, mastic, pipe boots, detail strip for installation under concrete slabs.
B. Related Sections
   1. Section 03 33 00 Cast-in-place Concrete

1.2 REFERENCES
A. American Society for Testing and Materials (ASTM)
   3. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.
   4. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
   5. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil 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. Independent laboratory test results showing compliance with ASTM & ACI Standards. ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.
   2. Manufacturer’s product data.
   3. Manufacturer’s installation instructions for placement, seaming and pipe boot installation.
   4. Single source: All materials and accessories must be provided by manufacturer and meet manufacturer’s written approval.

1.4 PRE-INSTALLATION MEETING
A. General Contractor to have vapor barrier installer attend cast-in-place concrete pre-installation meeting.
PART 2 – PRODUCTS

2.1 MATERIALS

A. Vapor Barrier
   1. Vapor Barrier must have the following qualities
      a. Strength: ASTM E 1745 Class A.
      b. Permeance Rating: ASTM E-96 Less than 0.01 perms after mandatory conditioning tests per ASTM E 1745 (7.1.1-7.1.5), not less than 15 mils (0.375 mm) thick.
      c. Puncture Resistance: ASTM D-1709 minimum 2200 grams
      d. Tensile Strength: ASTM D-88s minimum 50.0 lbf/in

2. Vapor Barrier Products
   a. Basis of Design: Stego Wrap (15 mil) Vapor Barrier by STEGO INDUSTRIES LLC, San Juan Capistrano, CA (877) 464-7834 www.stegoindustries.com
   b. Reef-Industries - Vaporguard.
   c. VaporBlock VB15 by Raven Industries.
   d. Substitutions: Not allowed.

2.2 ACCESSORIES

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

D. Mastic: Product recommended by vapor-retarder manufacturer for sealing vapor barrier penetrations.

E. Pipe Boots: Manufacturer’s standard, factory-fabricated boots, manufactured of 15 mil vapor barrier material.

F. Perimeter/Edge Seals: Manufacturer-recommended two-sided seaming tape and/or termination bars.
   1. Stego “Crete Claw” preferred for Stego installations.
   2. Stego “Stegotack” tape with term bar.
   3. Use of single-sided seaming tape to seal perimeter must be submitted to architect for pre-approval.

PART 3 – EXECUTION

3.1 PREPARATION

A. Ensure that below-slab conditions are as requested by manufacturer’s written installation instruction prior to installation.

3.2 INSTALLATION

A. Install vapor barrier in accordance ASTM E1643, or per manufacturer’s written installation instructions, whichever is more stringent.

END OF SECTION 07 27 00
SECTION 07 27 26
SELF-ADHERING SHEET AIR AND MOISTURE BARRIER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vapor-permeable self-adhered sheet air and water barrier.

1.2 RELATED SECTIONS

A. Section 03 30 00 Cast-in-Place Concrete.
B. Section 06 16 00 Sheathing.
C. Section 07 21 00 Thermal Insulation.
D. Section 07 42 43 Aluminum Composite Wall Panels

1.3 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 711 - Voluntary Specification for Self-Adhering Flashing Used for Installation of Exterior Wall Fenestration Products.

B. American Association of Textile Chemists and Colorists (AATCC):

C. ASTM International (ASTM):

D. Underwriters’ Laboratory, Canada:
   2. CAN/ULC-S742, Standard for Air Barrier Assemblies - Specification.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 00.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Physical properties, performance criteria, compliance reports, material compatibility, product limitations, and recommendations.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

C. Shop Drawings: Provide manufacturer’s typical, scaled, shop drawings with actual product names on details of:
1. Typical conditions.
2. Transitions to adjacent systems.
3. Mock-up, including plans and elevations.

D. Manufacturer’s Letter Indicating Compatibility: Submit letter or technical bulletin listing specific air barrier materials, and typical adjacent system materials; that are compatible, both chemically and adhesively.

E. Qualifications:
1. Submit manufacturer and installer qualifications.
2. Submit 5 project references within the last 5 years of similar-sized projects with self-adhered sheet membrane air barrier assembly installation by the proposed installing contractor.

F. Warranty: Submit manufacturer’s sample warranty.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primary weather barrier materials from a single manufacturer. Secondary and accessory materials by other manufacturers shall be approved for compatibility by the primary manufacturer.

B. Testing Laboratory Qualifications: Accredited by the International Accreditation Service (IAS), American Association for Laboratory Accreditation (A2LA).

C. Manufacturer Qualifications: Minimum 10 years of experience manufacturing similar products.

D. Installer Qualifications: Minimum 5 years of experience installing similar products and approved by the manufacturer.

E. Mock-Up:
1. Demonstrate the proper installation sequence and workmanship required for the air barrier assembly installation at typical conditions, transitions, openings, and penetrations through the exterior building envelope
2. Finish areas designated by Architect, minimum size 8 by 8 feet (2.4 by 2.4 m).
3. Exterior wall panel incorporating the back-up wall, window with sill, door frame, through-wall flashing, insulation, cladding, foundation, roof edge, and building corner. Show all air barrier assembly materials and seals. Coordinate with the Third-party Testing Agency for the size of testing area required for field testing the mock-up and allow testing prior to fully installing the insulation and cladding. Refer to Field Quality Control of this Section for test methods and quantity of tests.
4. Do not proceed with remaining work until workmanship is approved by Architect.
5. Approved mock-up represents the minimum quality for the Work for the air barrier assembly installation. Materials and installation procedures utilized in the mock-up become the standard of quality and construction for all subsequent similar conditions on the building.
6. Mock-up may remain as part of the finished Work, if approved by the Architect.
F. Functional Performance Testing:
   1. Owner’s testing agency will perform field functional performance testing. Refer to specification section 01 91 17 - Building Enclosure Functional Performance Testing for more information.

1.6 PERFORMANCE REQUIREMENTS

A. Assembly Performance:
   1. Standards Compliance:
      a. ASTM E 2357.
      b. CAN/ULC-S741.
      c. CAN/ULC-S742.

   2. Air Leakage: ASTM E2357:
      a. Opaque Wall: Less than 0.002 cfm/ft² at 1.57 psf.
      b. Penetrated Wall: Less than 0.006 cfm/ft² at 1.57 psf.

3. Loads from imposed pressures: Withstands design wind, fan, and stack pressures, both positive and negative, without damage or displacement of the air barrier assembly or adjacent materials. Allows transfer of these loads to the structure.

4. Movement: Allows for thermal, creep, and anticipated seismic and building movement within the air barrier assembly, each air barrier detail, and transitions to adjacent systems without breaching the air barrier system or negating specified air leakage performance.

5. Continuity: Joins air barrier materials and adjacent compatible materials and systems preventing air leakage and maintaining specified air leakage performance at the following locations and as shown on the Drawings:
   a. Transitions from roof air barrier to wall.
   b. Transitions from window, curtain wall, storefront, louvers, and doors to wall.
   c. Transitions from foundation waterproofing to wall.
   d. Transitions from one type of exterior cladding to another.
   e. Across construction, control, expansion, and seismic joints.
   f. Penetrations of utilities, pipes, conduit, and ducts.
   g. Penetrations of ties, anchors, and channels for exterior finishes.
   h. Pathways for potential air leakage into the building envelope.

1.7 COORDINATION

A. Coordinate Work of this Section with the work of other Sections that have work or materials connected to or passing through the air barrier assembly.
   1. Sequence of construction to ensure continuity of the barrier assembly at openings, transitions, and penetrations.
   2. Coordinate with installation of materials which cover the air barrier assemblies, to ensure exposure period does not exceed 12 months.
   3. Coordinate field observations and testing by specified parties.

1.8 PRECONSTRUCTION MEETINGS

A. Preconstruction Meeting: Prior to starting installation of the barrier system, conduct a preconstruction meeting at the job site to review the Project conditions and installation requirements.
   1. Attendance is required by:
      a. Installing contractor of the air barrier assembly.
      b. Representatives of related trades including exterior cladding, air barrier
substrate, penetrating work and systems, and adjacent material.
c. General Contractor.
d. Architect/Engineer.
e. Air barrier system manufacturer's field representative.
f. Owner's representative.
g. Third-party observer.
h. Field testing agency.

2. Agenda shall include:
a. Construction of the mock-up.
b. Sequence of construction and protection of installed air barrier assembly.
c. Substrate condition and preparation.
d. Materials approved for use.
e. Compatibility of materials.
f. Transition details between the various different types of barrier systems specified.
g. Coordination with installation of adjacent and cladding materials.
h. Project-specific details of construction.
i. Field observation and testing.
j. Repair of test and damaged areas.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Store in accordance with the manufacturer's instructions in clean, dry location protected from exposure to direct sunlight. Material that has been unwrapped shall be covered with opaque, light colored tarp or re-wrapped in manufacturer's packaging.

C. Use air barrier materials within 24 months from date of manufacture.

D. Handle materials to avoid damage.

1.10 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.
   1. Install membrane in temperature range from 0 degrees F to 150 degrees F.
   2. Install sealant in temperature range from 40 degrees F to 95 degrees. For application temperatures outside this range, please contact 3M Technical Services.

B. Install on substrates clear of dirt, debris, oils, other chemicals, snow, ice, frost, and moisture above the allowable limitations of the product.

C. Maximum exposure time of the air barrier assembly without cover or cladding is 12 months.

D. Provide weather protection at the top of walls and unfinished roofs at the end of each day.

1.11 WARRANTY

A. Manufacturer's Product Warranty: Provide manufacturer's product warranty for a minimum of ten years from date of Substantial Completion with installation completed by a certified 3M applicator.
B. Installer’s Workmanship Warranty: Provide workmanship warranty for a minimum of one year from date of Substantial Completion including all air barrier assembly materials and accessories, against failures including loss of air tight seal, loss of watertight seal, loss of attachment, loss of adhesion, and failure to cure properly.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: 3M Air Barrier Products

B. Substitutions: Allowed in accordance with Sections 00 26 00.

2.2 VAPOR PERMEABLE SELF-ADHERED AIR AND WATER BARRIER MEMBRANE

A. Membrane: 3M Air Barrier 3015VP Membrane, self-adhered, vapor permeable:
   1. Description: White proprietary film with acrylic adhesive, elastomeric coated, nonwoven backing, and polyester liner.
   2. Permeable to water vapor and impermeable to air and water.
   3. Resists UV exposure for up to 12 months.
   5. Weight: 12.8 oz/sq.yd.
   6. Total Membrane Thickness (ASTM D3652): 15 mils (0.38 mm).
   12. Service Temperature: -40 to 240 degrees F.
   13. Flammability:
      a. ASTM E84, flame spread index 5, smoke developed value 0, Rating Class A.
      b. Membrane in an approved wall assembly meets performance requirements of NFPA 285.

2.3 ACCESSORIES

A. Sealant: Polyurethane Sealant, one component, moisture curing: ASTM C920, Type S, Grade NS, Class 25:
   1. Product: 3M Polyurethane Sealant 540:
      a. Tack free: 60-90 minutes at 73 degrees F at 50% relative humidity.
      b. Elongation at Break (ASTM D882): 600 percent.
      c. Tensile Strength (ASTM D882): 300 psi.
   2. Product: 3M Polyurethane Sealant 525:
      a. Tack free: 90-150 minutes at 73 degrees F at 50% relative humidity.
      b. Elongation at Break (ASTM D882): 600 percent.
      c. Tensile Strength (ASTM D882): 400 psi.

B. Primer for Difficult Substrates: Use only if required by manufacturer or based on field conditions. Test adhesion before application.
   1. 3M Hi-Strength 90 Spray Adhesive.
   2. 3M Hi-Strength 94 ET Spray Adhesive.
   3. 3M Scotch-Weld Holdfast 70.
4. **3M Fastbond Contact Adhesive 30NF.**

**C. Membrane Flashing: 3M Self-Adhered Air and Vapor Barrier 3015 Membrane in detail widths.**

1. **Description:** Tan colored, semi-transparent proprietary film with acrylic adhesive and silicone coated release liner.
2. **Total Thickness (ASTM D3652):** 10 mils.
3. **Width(s):** Provide minimum width required to completely flash openings, penetrations etc with the fewest number of pieces.
4. **Elongation at Break (ASTM D882):** 700 percent.
5. **Tensile Strength (ASTM D882):** 1740 psi.
6. **Lap Adhesion (ASTM D3330):** 40 oz/inch.

**D. Liquid Flashing: 3M 3015LF Liquid Flashing.**

1. **Description:** Single component, polyether-based, water vapor permeable liquid flashing used alone or in combination with 3M 3015VP to create a continuous air/moisture barrier that dries fast, sticks to damp surfaces.
2. **Recommended Application Thickness (DFT):** 10-15 mils for sides and top of the openings, 50 mils for window sills.
4. **Water Resistance (AATCC127 55 cm of water for 5 hours):** No leakage.
5. **Surface Burning Characteristics (ASTM E84):** Flame spread index 15, smoke developed 0; ICC AC 38 Class A Value Rating.
6. **Application Temperature:** 25 to 100 degrees F.
7. **Service Temperature:** -40 to 240 degrees F.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

A. Do not begin installation until substrates have been properly prepared.

B. Substrate surfaces shall be free of grease, oil, unbonded paint, corrosion or other substances.

C. Verify that substrate construction is complete, clean, dry, and ready to receive barrier system with no damaged or unsupported areas; or sharp protrusions or voids. Substrate must meet the following requirements:

1. **Exterior gypsum sheathing:** Moisture content below 19 percent; no open joints or cracks wider than 1/4 inch.
2. **Plywood:** Moisture content below 16 percent; no open joints or cracks wider than 1/4 inch.
3. **Concrete surfaces:** Cured minimum 7 days, fins and extrusions ground flush and void areas filled and cured.
4. **Masonry:** Mortar joints struck flush.
5. **Metal:** Wipe down to remove any release agents or coatings.

D. If substrate preparation is the responsibility of another installer, notify Architect and General Contractor of unsatisfactory preparation before proceeding.

**3.2 PREPARATION**

A. Connection to Difficult Substrates and Other Systems:

1. Test adhesion by installing a 6 inch square test patch of barrier product over the difficult substrate or other system. Removal of the test patch should not be possible.
without permanent damage to either the test patch or substrate material.
2. Consult the manufacturer for detailing connections that fail this test.

B. Gaps or cracks in substrate exceeding 1/4-inch width: Fill gap or crack with sealant and tool surface flush and smooth.

C. Penetrations of air barrier assembly: Fill gaps or cracks exceeding 1/4-inch (6 mm) width between the substrate and the penetration with sealant.

D. Gaps or cracks in substrate exceeding 1/2-inch width: Fill gap or crack with closed-cell backer rod or spray foam. Once the spray foam is cured, shave flush to adjoining substrate.

3.3 INSTALLATION

A. Install vapor permeable membrane in accordance with manufacturer’s instructions in locations shown on the drawings to provide a continuous weather barrier.
1. 3M 3015VP shall be installed horizontally. Vertical installation will not be accepted.
2. Provide the manufacturer required overlap between adjacent courses.
3. Horizontal applications should be applied so the top row overlaps the lower row, creating a shingling effect.
4. Install in accordance with manufacturer’s written installation instructions.

B. Window and Louver Openings:
1. Wrap rough openings as detailed in the Drawings with either flashing or membrane material in detail widths.
2. Install sealant at each inside corner of the window sill, jamb, and head.
3. Apply detail strips of membrane at each inside corner extending the full depth of the sill and a minimum 2 inches onto the face.
4. Install detail strips at the sill, jambs, and head in lengths beyond window opening extending the full depth of the sill.
5. Apply reinforcing piece cut into a football, bowtie, or butterfly shape at each corner.
6. Install membrane in "weatherboard" or "shingle fashion" with a minimum 2 inch overlap at all detail strips.

C. Penetrations:
1. Seal all penetrations with sealant. Install flashing or membrane material cut to length to allow installation around the full circumference of penetration.
2. Apply membrane around all penetrations in accordance with manufacturer’s written installation instructions.

D. Repairs: Apply membrane 2 inch larger than test or damage area. Seal leading cut edges of membrane with sealant.

3.4 FIELD QUALITY CONTROL

A. Coordinate with Owner’s testing agency to inspect installation areas with the manufacturer’s authorized technical representative and the Architect. Do not cover weather barriers until accepted.

3.5 CLEANING AND PROTECTION

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the air barrier assembly manufacturer.
B. Protect air barrier materials from damage during installation and the remainder of the construction period.

C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 07 27 26
SECTION 07 41 00
MANUFACTURED METAL ROOFING PANELS – LOW SLOPE

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this section.

1.2 SUMMARY

A. Work described in this section includes pre-formed metal roofing system complete with clips, perimeter and penetration flashing, fascia, closures and miscellaneous prefinished metal associated with the standing manufactured metal roofing panel system.
   1. Metal Roof Panel system delineated in this section will be referred to as ‘standing seam metal roofing’ on drawings.

B. Related Work Specified Elsewhere:
   1. Division 05 Section - Metal Decking
   2. Division 07 Section – Thermal Insulation
   3. Division 07 Section - Sheet Metal Flashing and Trim
   4. Division 07 Section - Roof Specialties

1.3 REFERENCES

A. American Society of Civil Engineers (ASCE):

12. ASTM E2140 - Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head

C. Testing Application Standards TAS
1. TAS 100 Test Procedure for Wind and Wind Driven Rain Resistance of Discontinuous Roof Systems
2. TAS 125 Standard Requirements for Metal Roofing Systems
3. TAS 114 app. G Test Procedure for Susceptibility to Leakage of Discontinuous Roof Systems

D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

E. Underwriters' Laboratories (UL):
1. UL 263 Fire Tests of Building Constructions and Materials.
2. UL 580 Tests for Uplift Resistance of Roof Assemblies.

1.4 SUBMITTALS FOR REVIEW

A. Shop Drawings showing layout of roof panels and structural supporting member required in the installation with side laps and end laps marked within 1% deviation of their actual location.
1. Provide details for edge conditions, seams, joints, corners, panel profiles, assembly anchoring techniques, round and square flashings and counter flashings.

B. Samples illustrating thickness, finish, color and textures of materials.

C. Product Data: Include manufacturer's detailed material and system description, panel and field seam installation instructions, engineering performance and finish specifications. Indicate hat channel and fastener spacing if applicable.

D. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the Owner.

E. Any material submitted as equal to the specified material must be accompanied by a report signed and sealed by a professional engineer licensed in the state in which the installation is to take place. This report shall show that the submitted equal meets the Design and Performance criteria in this specification. Substitution requests submitted without licensed engineer approval will be rejected for non-conformance.

1.5 SUBMITTALS FOR INFORMATION

A. Design and Test Reports: Provide the following certified test reports from an independent testing laboratory:
1. Independent laboratory testing report for system design load and seam integrity.
2. Professional engineer's documentation that roofing system incorporates sufficient allowance for stress and movement.
3. A letter from an officer of the manufacturing company certifying that the materials furnished for this project are the same as represented in tests and supporting data.
4. Manufacturer's verifications that the panels are factory roll formed.
5. ASTM E1592: Test results must clearly demonstrate compliance with the following requirements:
   a. The ultimate test failure load shall be reduced by the safety factor specified in article 1.11 to determine the allowable working load for the panel system.
   b. The proposed system has been tested to insure that the allowable working load of the panel system meets or exceeds the specified negative wind uplift pressures listed in article 1.11 of this specification for all roof zones.
   c. The test results are applicable for the thickness, width, and profile specified. Results are not applicable for systems that are thinner or wider than the system which was tested. If the tested material was not the specialty material specified herein (for instance, the tested material was galvalume steel), then the test results shall be reduced by the ratio of the yield strength (Fy) of the specified material to the tested material.
   d. The results must clearly show that the allowable clip spacing meets or exceeds the requirements specified in section 3.3.C for all roof areas. Clip spacing shall not be reduced for any roof zone from that which is specified.

6. ASTM E283 and E331: Test results must clearly demonstrate compliance with the performance requirements specified in article 1.11.

7. ASTM E1646 and E1680: Test results must clearly demonstrate compliance with the performance requirements specified in article 1.11. Results are not applicable for systems that are thinner, wider, lower grade, or different material/profile than the system which was tested. The differential test pressures must be identical to those specified in article 1.11.

8. UL 580: The proposed roof panel shall be listed as UL 580, Class 1-90.

9. UL 790: The proposed roof panel shall be listed as a non-combustible roof covering material and be approved for use in a UL classification assembly.

10. UL 263: The proposed roof panel shall be listed for use in a UL fire rated construction assembly.

11. FM 4471: Test report must be submitted for windstorm rating no less than that specified in article 1.11. The proposed roof system must have approval over the specified substrate with clips spaced as specified in article 3.4.C for roof Zone 1.

12. AAMA 501.1: Test report shall show passed ratings for panel type as specified.

13. TAS 100: Test report shall show passed ratings for panel type as specified.

14. TAS 125: Test report shall show rating no less that that as specified in article 1.11.

15. TAS 114 appendix G: Test report shall show passed ratings for panel type as specified.

16. ASTM E2140: Test report shall show passed ratings for panel type as specified.

B. Mill production reports certifying that the steel thicknesses are within allowable tolerances of the nominal or minimum thickness or gauge specified.

C. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7-05, Method 2 for Components and Cladding. In no case shall the design loads be taken to be less than those detailed in Design and Performance Criteria article.

D. Qualification Data for Roofing Installer: Refer to Quality Assurance Article below.

E. Certification of work progress inspection frequency: Refer to Quality Assurance Article below.

F. Pre-installation Roofing Conference Proceedings: Refer to Quality Assurance Article below.

1.7 CONTRACT CLOSEOUT SUBMITTALS
A. General: Comply with Requirements of Division 01 Section Closeout Submittals.

B. Special Project Warranty: Provide specified warranty for the Project, executed by the authorized agent of the Manufacturer.

C. Roofing Maintenance Instructions: Provide a manual of manufacturer's recommendations for maintenance of installed roofing systems.

D. Insurance Certification: Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

E. Demonstration and Training Schedule: Provide a schedule of proposed dates and times for instruction of Owner's personnel in the maintenance requirements for completed roofing work. Refer to Part 3 for additional requirements.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer who has completed the Manufacturer's Approved Roofing Contractor course and is currently certified for the installation of this roof system.

B. If required, fabricator/installer shall submit work experience and evidence of adequate financial Responsibility. The Owner's representative reserves the right to inspect fabrication facilities in determining qualifications.

C. Source Limitations: Obtain all components of roof system from a single manufacturer, including roll goods materials if required. Secondary products that are required shall be recommended and approved in writing by the roofing system Manufacturer.
   1. Upon request of the Architect or Owner, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.
   2. Manufacturer shall have direct authority and control over all fabrication of steel components as well as the raw materials used in their fabrication.

D. Source Quality Control: Manufacturer shall have in place a documented, standardized quality control program such as ISO-9001 approval.

E. Engage the Manufacturer's Field Representative to conduct required periodic inspections of work in progress as described herein and shall furnish written documentation of all such inspections.

F. Manufacturer shall provide the project Owner with a written statement that they will provide a site inspection every [1] days that confirms that the project is being constructed as specified, by an experienced, full time employee of the company.

G. Alternate Manufacturers: The following manufacturer criteria must be submitted. Alternate systems will not be considered for approval unless each of these items has been submitted for review at least 10 business days prior to bid opening:
   1. Submit each item listed in article 1.4 (A through E) for evaluation of the proposed system.
   2. Tests shall have been made for identical systems within the ranges of specified performance criteria.
   3. Empirical calculations for roof performance shall only be acceptable for positive loads.
   4. A list of a minimum of five (5) jobs where the proposed alternate material was used under similar conditions. The reference list shall include date of project, size of project, project address, and telephone number of architect/owner contact.
   5. A financial statement demonstrating a minimum of a 3:1 ratio of assets to liabilities.
6. A written statement from the manufacturer stating that they will provide the building owner with a daily site inspection for a minimum of one (1) hour per day by an experienced, full time employee of the company.

7. A written statement from the manufacturer stating that they will provide the engineer of record with a daily site inspection by an experienced full time employee of the company.

8. A written statement from a corporate officer of the manufacturing company stating that he or she has reviewed the specifications and confirms that the proposed system meets or exceeds all performance requirements listed as well as meets the panel size, gauge, weight, clip design, sealant design, uplift pressures and height of the vertical seam.

9. A copy of manufacturer's 30 year warranty. Warranty must include coverage for all trim, flashing, and penetrations associated with this roof.

10. Proof that the manufacturer has been in business for a minimum number of years equal to the warranty period required for this project.

H. Site Formed Panels: Site formed panels are prohibited. All metal panels must be factory pre-manufactured and engineered for this project.

I. Site Formed Panels: Panels in excess of shippable length shall be formed on-site. Site formed panels shall meet each of the following requirements:
   1. Panels shall be formed on heavy duty factory type roll formers. Roll formers shall gradually form the panel profile utilizing no fewer than twelve (12) forming stations to improve quality and minimize oil canning.
   2. All tooling shall be polished and tempered to a minimum hardness of Rockwell C - 52. Tooling shall be maintained clean and in good working condition. Tooling repairs or modifications made by means of welding, sawing, grinding, or the like are unacceptable, as they may contribute to poor quality, aesthetics, and performance of the end product.
   3. Panels shall be of identical profile and characteristics as factory formed panels and specimens used as the basis of performance tests.
   4. Sealant shall be factory applied in a separate factory formed snap on cap. Site/field applied seam sealant is unacceptable. Seam caps may be shipped in forty-five (45) feet or less length and lap spliced over full length panels in accordance with manufacturer's system details.
   5. Site roll forming equipment shall be operated by a trained full time experienced technician. The installer must provide additional personnel to handle raw materials and finished product as necessary.

1.9 PRE-INSTALLATION CONFERENCE

A. Convene a pre-roofing conference approximately two (2) weeks before scheduled commencement of roofing system installation and associated work.

B. Require attendance of installer of each component of associated work: installers of deck or substrate construction to receive roofing work; installers of rooftop units and other work in and around roofing which must precede or follow roofing work (including mechanical work if any); Architect; Owner; roofing system manufacturer's representative; and other representatives directly concerned with performance of the Work, including (where applicable) Owner's insurers, testing agencies and governing authorities.

C. Objectives of conference to include:
   1. Review foreseeable methods and procedures related to roofing work, including set up and mobilization areas for stored material and work area.
   2. Tour representative areas of roofing substrates (decks) inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by others.
3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
4. Review roofing system requirements (drawings, specifications and other contract documents).
5. Review required submittals both completed and yet to be completed.
6. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
7. Review required inspection, testing, certifying and material usage accounting procedures.
8. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not mandatory requirement).
9. Record discussion of conference including decisions and agreements (or disagreements) reached. Furnish a copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
10. Review notification procedures for inclement weather or non-working days.

D. The Owner's Representative will designate one of the conference participants to record the proceedings and promptly distribute them to the participants for record.

E. The intent of the conference is to resolve issues affecting the installation and performance of roofing work. Do not proceed with roofing work until such issues are resolved to the satisfaction of the Owner and Engineer of Record. This shall not be construed as interference with the progress of Work on the part of the Owner or Engineer of Record.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Responsibilities:
   1. All roof panels shall be shipped from the manufacturer with strippable film or similar packaging material separating the individual panels to minimize flexing, stressing, scratching or otherwise damaging the material during transit to the job.
   2. Fully cover panels with tarpaulins or similar protective cover during transit to prevent dirt and debris from coming in contact with the finished goods.

B. Installer's Responsibilities:
   1. Stack pre-finished materials to prevent twisting, bending, abrasion and denting and elevate one end to facilitate moisture run-off.
   2. Unload roof panels using a boom or crane, supporting the panels in at least two locations during lifting, and never lift more than three panels at a time.
   3. Protect moisture-sensitive and water-based materials from the weather.
   4. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

1.11 PROJECT CONDITIONS

A. Determine that work of other trades will not hamper or conflict with necessary fabrication, storage and protection requirements for roofing system.
   1. Protection:
      a. Protect completed roofing from subsequent construction operations. Comply with Manufacturer's recommendations.
      b. Do not overload roof with stored materials.
      c. Support no roof-mounted equipment directly on the roofing system.
B. Ascertain that work of other trades which penetrates the roof or is to be made watertight per Manufacturer's recommendations and approved prior to installation of roofing.

1.12 DESIGN AND PERFORMANCE CRITERIA

A. Thermal Expansion and Contraction:
   1. Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling; producing excess stress on: structure, anchors or fasteners; or reducing performance ability.
   2. The design temperature differential shall be not less than [insert design temperature differential (200º F)].
   3. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.
   4. Location of metal roofing rigid connector shall be at roof ridge unless otherwise approved by the Project Architect. Metal ridge connector may require design as per job conditions by specified manufacturer.

B. Uniform Wind Load Capacity: (per roof section)
   1. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria. Anchor clips shall be installed exactly as spacing given in article 3.3.
      b. Safety Factor: 1.650 after any load reduction or material stress increase.
      c. Category [III] Building with an Importance Factor of [1.15].
      d. Wind Speed: [90] mph.
      e. Ultimate Pullout Value: [contact Garland sales rep.] pounds per each of the two fasteners holding the panel anchor to the roof decking or framing system.
      f. Exposure Category: [C].
      g. Design Roof Height: [25.3] feet.
      h. Minimum Building Width: [56.33] feet.
      i. Roof Pitch: [.5] inches per foot
      j. Roof Area Design Uplift Pressure:
         Zone 1 - Field of roof 20.3 psf.
         Zone 2 - [34.1] psf.
         Zone 3 - Corners [51.3] psf.
      Capacity shall be determined using in accordance with ASTM E1592, testing of sheet metal roof panels. Allowable safe working loads shall be determined by dividing the ultimate test load by the safety factor specified above.

C. Uniform Positive Load Capacity.
   1. The installed roof system shall be capable of resisting the following positive uniform roof loads: Roof Live Load of 20 psf.; Roof Snow Load of [center required snow load here] psf.
   2. Capacity to resist positive loads shall be determined by empirical calculations in accordance with AISI. Calculation shall be sealed by a registered professional engineer.
   3. Installed roof system shall carry positive uniform design loads with a maximum system deflection of L/180 as measured at the rib (web) of the panel.

D. Underwriters' Laboratories, Inc., (UL) fire resistance P ratings for roof assemblies: If applicable, panel system shall be approved for use in an appropriate Construction Assembly, as defined by UL 263.
E. Underwriters’ Laboratories, Inc., (UL), wind uplift resistance classification: Roof assembly shall be classified as Class 1-90, as defined by UL 580.

F. Underwriters’ Laboratories, Inc., (UL) Class A fire rating per UL 790.

G. ASTM E283: Static pressure air infiltration (doors, windows, curtain walls):
   1. Pressure Leakage Rate
   a. 1.57 PSF 0.0007 cfm/sq.ft.
   b. 6.24 PSF 0.0002 cfm/sq.ft.
   c. 20.0 PSF 0.0036 cfm/sq.ft.

H. ASTM E331: Static pressure water infiltration (doors, windows, curtain walls):
   1. Pressure Result:
   a. 5 Gal./Hr. per S.F. and Static No Leakage
   b. Pressure of 20.0 Psf for 15 minutes

I. ASTM E1680: Static pressure air infiltration (roof panels):
   1. Pressure Leakage Rate:
   a. 1.57 PSF 0.0012 cfm/sq.ft.
   b. 6.24 PSF 0.0001 cfm/sq.ft.
   c. 20.0 PSF 0.0011 cfm/sq.ft.

   1. Pressure Leakage Rate:
   a. 1.57 PSF 0.0054 cfm/sq.ft.
   b. 6.24 PSF 0.0054 cfm/sq.ft.
   c. 20.0 PSF 0.0027 cfm/sq.ft.

J. ASTM E1646: Static pressure water infiltration (roof panels):
   1. Pressure Result:
   a. 5 Gal./Hr. per S.F. and Static No Leakage
   b. Pressure of 20.0 Psf for 15 minutes

K. Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within the range of test data. Extrapolations for conditions outside test range are not acceptable.

L. Water penetration (dynamic pressure): No water penetration, other than condensation, when exposed to dynamic rain and 70 mph wind velocities for not less than five minutes duration, when tested in accord with principles of AAMA 501.1.

M. Wind and wind driven rain resistance: No water penetration or panel movement when exposed to 110 mph wind velocities when tested in accordance with TAS 100.

N. The installed roof system assembly shall show that it can resist the calculated roof pressure in section 1.11.B in accordance with the test results of TAS 125.

O. Water penetration in low slope applications: No water penetration or panel movement when subject to 6” head of water for 6 hrs when tested in accordance with the ASTM E2140 and when subject to 6” head of water for 7 days when tested in accordance with the TAS 114 appendix G.
1.13 Warranties

A. Manufacturer shall execute a single warranty covering the following criteria. Multiple-source warranties are not acceptable.
   1. Manufacturer’s 30 year watertight warranty, including coverage for all trim, flashings, and penetrations associated with the roof area.
   2. 25 year coverage on finish including checking, crazing, peeling, chalking, fading and/or adhesion.
   3. Warranty shall commence on date of substantial completion [or final payment], whichever is agreed by contract.
   4. Installer shall provide manufacturer with 20 year warranty covering roofing system installation and water tightness.
   5. Provide a single warranty by a single approved manufacturer for standing seam roof areas, membrane roof areas, and transitions between the two material types.

1.14 Manufacturer’s Inspections

A. When the project is in progress, the roofing system manufacturer will inspect the work not less than 2 days per week. In addition, the manufacturer will:
   1. Keep the Architect or Owner informed as to the progress and quality of the work as observed.
   2. Report to the Architect in writing any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor’s attention.
   3. Confirm after completion that manufacturer has observed no application procedures in conflict with the specifications other than those that may have been previously reported and corrected.

PART 2 — PRODUCTS

2.1 Standing Seam Roofing System

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates and accessories required for watertight installation.
   1. The products, quality, and performance criteria specified shall be regarded as the minimum standard of quality required for the project.
   2. Basis of Design: R-MER Span System manufactured by the Garland Company, Cleveland, OH.

B. Materials.
   1. Panel material: 24-gauge, Galvalume steel, type AZ-55, smooth as per ASTM A792-96.
   2. Fascia, flashing and flat-stock material:
      a. Thickness: 22-gauge.
      b. Fabricate in profiles indicated on drawings.
      c. Finish: Match panel color and finish.

C. Finish on Surfaces.
   1. Exposed surfaces for coated panels:
      a. Two-coat coil applied, baked-on full-strength (70% resin) fluorocarbon coating system (polyvinylidene fluoride, PVF2), applied by manufacturer’s approved applicator.
b. Coating system shall provide nominal 1.0 mil dry film thickness, consisting of primer and color coat.

c. Color shall be **Sterling Silver as manufactured by Garland**. If manufacturer besides Garland is selected, provide custom color to match.

2. Unexposed surfaces for coated panels shall be baked-on polyester coating with 0.20 - 0.30 dry film thickness (TDF).

3. Exposed and unexposed surfaces for uncoated panels shall be as shipped from the mill.

D. Characteristics.

1. Provide the same panel profile from a single manufacturer for all standing seam roof areas.

2. Provide standing seam panels incorporating mechanically interlocked, concealed anchor clips allowing unlimited thermal movement, and of configuration which will prevent entrance or passage of water.
   
   a. Panel/Cap configuration must have a total of four (4) layers of steel surrounding anchor clip for prevention of water infiltration and increased system strength designed to limit potential for panel blow-off.

   b. Profile of panel shall have mesa's every two (2) inches on center continuous throughout panel which are a minimum of one and one-half (1-1/2) inches wide.

   c. Exposed fasteners, screws and/or roof mastic are unacceptable and will be rejected. System configuration only allows for exposed fasteners at panel overlap (if required) and trim details (as per manufacturer's guidelines).

   d. Provide panels in continuous lengths from ridge to eave with no overlaps unless approved by manufacturer, in writing.

   e. Seam caps shall be manufactured in the factory and may be installed with end laps. Seam sealant must be factory applied.

   f. Seam caps shall be manufactured in the factory and may be installed with end laps. Seam sealant must be factory applied.

3. Seam must be two and three-eighths (2-3/8) inches minimum height for added upward pressures and aesthetic appeal. Seam shall have continuous anchor reveals to allow anchor clips to resist positive and negative loading and allow unlimited expansion and contraction of panels due to thermal changes. Integral (not mechanically sealed) seams are unacceptable.

4. Seam cap: Snap-on cap shall be a minimum of 2-inch wide "T" shaped of continuous length up to forty-five (45) feet according to job conditions and field seamed by means of manufacturer's standard seaming machine.
   
   a. Cap shall be designed to receive two (2) beads of continuous hot applied gasketing sealant, which will be applied independent of anchor clip, to allow unlimited thermal movement of panel without damage to cap sealant.

   b. Sealant shall be a SIS (Styrene-Isoprene-Styrene) block copolymer type thermoplastic rubber adhesive, non-fatigue water barrier

5. Standing Seam Panel Width: 16".

6. Stiffening ribs: Located in flat of panel to minimize oil canning and telegraphing of structural members.

7. Replaceability: Panels shall be of a symmetrical design with snap on, mechanically seamed cap configuration such that individual panels may be removable for replacement without removing adjacent panels.

8. Panel ends shall be panned at ridge, headwall, and hip conditions, or where applicable.


F. Accessories.

1. Gable anchor clips for:
a. Standing Seam style.
b. Galvalume steel, type AZ-55, minimum thickness: 16 gauge

2. Fasteners:
a. Concealed fasteners: Corrosion resistant steel fasteners (zinc plated, stainless steel or equal) designed to meet structural loading requirements. Provide #14 as the minimum fastener size.

G. Exposed fasteners: Series 410 stainless steel fasteners or one-eighth (1/8) inch diameter stainless steel waterproof rivets. All exposed fasteners shall be factory painted to match the color of the standing seam panels.
   1. Closures: Factory precut closed cell foam meeting ASTM D1056 or ASTM D3575, enclosed in metal channel matching panels when used at hip, ridge, rake, and jamb.
   2. Provide all miscellaneous accessories for complete installation.
   3. Panel joint (end lap) sealant: Non-curing modified isobutylene tri-polymer tape of thickness to fully adhere to both surfaces being joined with indicated service life of 20 years.

2.2 ACCESSORY PRODUCTS

A. Sealant:
   1. Acceptable product:
      a. Concealed Application: Non-curing butyl sealant or equal.
      b. Exposed Application: Garland SS sealant or equal.
   2. Colors: As selected by architect from sealant manufacturer's standard selection.

B. Self-adhered Roofing Underlayment:
   1. Non-asphaltic based, breathable roofing underlayment shall be applied over entire roof area.
   2. Provide one of the following products:
      a. ATA-Guard as manufactured by ATAS International, Inc.
      b. Delta-Trela as manufactured by Cosells-Dorken Products Inc.
      c. Nova Seal II as manufactured by Engineered Coated Products
      d. Storm Guard as manufactured by GAF Materials Corporation

C. Insulation:
   1. Specified other sections.

D. Bearing Plates:
   1. Install bearing plates directly over rigid board insulation/underlayment at each anchor clip location.
   2. Bearing plates shall be three by five (3 x 5) inch by sixteen (16) gauge, minimum galvanized steel.
   3. Bearing plates shall be pre-punched with a hole pattern matching that of the panel anchor clips. Slotted holes are acceptable.

E. Snow Guard: Manufacturer: S-5!, ColorGuard by Metal Roof Innovations, LTD.

F. Gutters and Downspouts:
   1. Fabricate from the following materials: Match panel material.
   2. Thickness: 22-gauge.
   3. Color and Finish: Match panel color and finish.
   4. Provide all gutter and downspout accessories, including endcaps, hangers, straps, etc.
5. Provide shop-fabricated elbow and cover at storm piping connections. Refer to civil documents for locations and quantities.
6. Coordinate installation with rain barrel installer and/or manufacturer.

G. Modular Rain Storage Tank
2. Description: Modular, flat-sided, fully enclosed tank used to collect and store rainwater from a roof for use in landscaping or within a building. Modular Rain Storage tanks attach to the gutters or downspouts of a structure and can be used singly or in groups, positioned vertically or horizontally with the supplied connectors.
3. Tank Material: Food grade, medium-density polyethylene tank with a UV8 UV stabilization rating. Tank plastic complies with FDA and HPB regulatory standards for food contact. Connections approved for potable water applications AS4020.
   a. Physical properties:
      1) Color: Bronze Olive
      2) Dimensions 9 ½ x 71 x 20"
      3) Wall thickness: 1/8-inch
      4) Tensile Strength: 2550psi
      5) Weight: empty 40lb/ full 440lb
      6) Fire Rating: Underwriters Laboratories (UL) flammability standard 94HB for tank material.
   b. Includes four (4) 1-inch NPT brass threaded connectors cast into each HOG – two at the top and two at the bottom of each tank for connection to additional modular rain storage tanks.
   c. Includes one (1) heavy-duty Schedule 80 PVC threaded connection fitting and a screened elbow vent, both approved for potable water applications.
4. Accessories:
   a. Wall-mount kit for lateral stability: Wall-mounted stainless-steel Unistrut channel, spring nut, threaded rod, 3-mm stainless steel plate and stainless-steel dome nut.
   b. Leaf Filter:
      1) Product: Rain Harvesting Pty Leaf Eater Advanced Rain Head.
      2) Coordinate with associated components to ensure correct size.
5. Piping:
   a. Thickness: Schedule 40 PVC piping for all piping and connections.
6. Installation: Install in accordance with manufacturer’s written installation instructions to provide a full and complete functioning system.

2.3 FABRICATION

A. Shop fabricate metal roofing and flashing components to the maximum extent possible, forming metal work with clear, sharp, straight, and uniform bends and rises. Hem exposed edges of flashings.

B. Form flashing components from full single width sheet in minimum ten (10) foot lengths. Provide shop fabricated, mitered corners, joined using closed end pop rivets and joint sealant.

C. Fabricate roofing and related sheet metal work in accordance with approved shop drawings and applicable standards.
PART 3 — EXECUTION

3.1 EXECUTION, GENERAL

A. Comply with requirements of Division 01 Section "Common Execution Requirements."

3.2 PREPARATION

A. Design system so that the panel installation may be started and/or terminated at any given point in the area.
   1. It is understood that the ongoing operations of the Owner are of a critical nature as to leak sensitivity. Do not work on more roof area than can be restored completely watertight in one day.

B. Remove existing loose material, dirt and debris from the roof area. All accumulations of asphalt or other repair materials shall be removed to provide a smooth, flat substrate without imperfections that will be evident in the finished work.
   1. Existing metal details and other metal accessories specified for re-use that interfere with the installation of the new roof system shall be carefully removed and set aside for re-use.
   2. Any metal described above that will come in contact with the new roof shall be checked for type and replaced or protected if galvanic action may be a problem.

C. Strip existing contaminating material from all metal components that are indicated to be re-utilized. Protect these metal components. Replace damaged components with new of similar type and dimension.

D. Replace wood blocks and/or sleepers indicated to be replaced with new redwood, or other form of blocking acceptable to the Manufacturer.
   1. Do not use pressure-treated wood or materials corrosive to steel. Provide Material Safety Data Sheets to the roofing manufacturer for verification prior to installation.

E. Remove pipes, conduits or equipment indicated to be abandoned and removed.

F. All curbs, soil stacks, and other interior flashing surfaces shall be extended to a minimum of eight (8) inches above the new horizontal roof surface or shall be pressure sealed at the top edge.

3.3 INSTALLATION, GENERAL

A. Install roof system when the atmospheric dry bulb temperature is minimum forty (40) degrees Fahrenheit and rising.

B. Install all components of the roof system in exact accordance with the manufacturer's standard published procedures as applicable to these project conditions and substrates.

C. Install all required vapor retarder, air seals and preliminary tapered insulating substrates required per enclosed specifications.

D. Lay out and anchor all roof framing sections or purlins according to the approved roof plan.
3.4 ROOFING AND FLASHING INSTALLATION

A. Comply with all details and install roofing materials and flashings in accordance with approved shop drawings and manufacturer’s product data within specified erection tolerances.

B. Prepare roof for the installation of standing seam panels, including:
1. Install all decking, framing, and/or furring members as indicated in this specification and bid documents.
2. Install all insulation, vapor retarder, and/or air infiltration barriers as indicated in this specification and bid documents.
3. Install all underlayments and/or temporary waterproofing materials as required in this specification and bid documents.

C. Directly over the completed roof substrate, install one (1) piece panel anchor clips. [All anchor clips will be set on sixteen (16) gauge galvanized, pre-punched bearing plates to distribute the loads on the board insulation] All anchor clips will be fastened into the structural roof substrate based on the following spacing pattern.
1. Clip spacing must be [4'-10"] for Zone 1 (field)
2. Clip spacing must be [2-10"] for Zone 2 (eave, [ridge, hip,] and rake).
3. Clip spacing must be [2"] for Zone 3 (corners)
4. Clip spacing for Zones 2 & 3 must extend [5.8.] feet onto the roof area.

D. Installation of Roof Panels: Roof panels can be installed by starting from either end and working towards the opposite end. Due to the symmetrical design of the specified panel system, it is also acceptable to start from the middle of the roof and work toward each end.
1. A stainless steel pop rivet shall be secured through the anchor reveal of the panel leg and extend into the arms of the panel clip located at the ridge of the system. Provide at each arm of the clip along the ridge. The panel is then anchored at both sides of the clip.
   a. Capture all drilling debris during this operation with a rag or cloth placed on the panels at the drilling operation.
   b. Panels are not securely attached to the roof until fixed to the anchor clip. To avoid damage and injury, all panels shall be fixed to the anchor clip immediately as they are installed.
2. Un-installed panels which are temporarily stored on the ground or roof shall be secured in place at the end of each day’s work to prevent possible damage or injury.
3. A hand crimping tool is used to crimp the cap around the top of two adjacent panels
4. Caps shall then be permanently seamed with manufacturer's mechanical seamer.
5. At the end of each day's work, seam caps shall be mechanically seamed or hand cramped (crimp 4 inches every 8 feet) to reduce the possibility of wind damage prior to completion of the project.
6. Un-installed panels which are temporarily stored on the ground or roof shall be secured in place at the end of each day's work to prevent possible damage or injury.

E. Fasteners shall not penetrate the lower, exposed portion of roof decking in areas with acoustical decking. Fasteners shall penetrate the upper rib, but shall not be exposed to view from below the roof decking.

F. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.

G. Limit exposed fasteners to extent indicated on shop drawings.
H. Anchorage shall allow for temperature expansion/contraction movement without stress or elongation of panels, clips, or anchors. Attach clips to structural substrate using fasteners of size and spacing as determined by manufacturer's design analysis to resist specified uplift and thermal movement forces.

I. Seal laps and joints in accordance with roofing system manufacturer's product data.

J. Provide for temperature expansion/contraction movement of panels at roof penetrations and roof mounted equipment in accordance with system manufacturer's product data and design calculations.

K. Installed system shall be true to line and plane and free of dents, and physical defects. In light gauge panels with wide flat surfaces, some oil canning may be present. Oil canning does not affect the finish or structural integrity of the panel and is therefore not cause for rejection.

L. Maximum variation from true planes or lines shall be one-fourth (1/4) inch in twenty (20) feet and three-eighths (3/8) inch in forty (40) feet of more.

M. Form joints in linear sheet metal to allow for one-fourth (1/4) inch minimum expansion at twenty (20) feet on center maximum and eight (8) feet from corners.

N. At joints in linear sheet metal items, set sheet metal items in two (2) one-fourth (1/4) inch beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

O. Remove damaged work and replace with new, undamaged components.

P. Touch up exposed fasteners using paint furnished by roofing panel manufacturer and matching exposed panel surface finish.

Q. Clean exposed surfaces of roofing and accessories after completion of installation. Leave in clean condition at date of substantial completion. Touch up minor abrasions and scratches in finish.

3.5 CLEANING

A. Clean installed work in accordance with the manufacturer's instructions.

B. Replace damaged work than cannot be restored by normal cleaning methods.

3.6 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated during roofing procedures. Comply with requirements of authorities having jurisdiction.

3.7 FINAL INSPECTION

A. At completion of roofing installation and associated work, meet with Contractor, Architect, installer, installer of associated work, Owner, roofing system manufacturer's representative and other representatives directly concerned with performance of roofing system.

B. Inspect roofing work and flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.
C. Repair or replace deteriorated or defective work found at time of above inspection as required to produce an installation which is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

D. Notify the Contractor and Architect upon completion of corrections.

E. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

F. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty four (24) hours, the Owner will exercise rights to correct the Work under the terms of the Conditions of the Contract.

3.8 DEMONSTRATION AND TRAINING

A. At a time and date agreed to by the Owner, instruct the Owner's facility manager, or other representative designated by the Owner, on the following procedures:
   1. Roof troubleshooting procedures.
   2. Notification procedures for reporting leaks or other apparent roofing problems.
   3. Roofing maintenance.
   4. The Owner's obligations for maintaining the roofing warranty in effect and force.
   5. The Manufacturer's obligations for maintaining the roofing warranty in effect and force.

END OF SECTION 07 41 00
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes metal-faced composite wall panels in a Rout and Return Dry panel system.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal-faced composite wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Provide metal-faced composite wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
   1. Wind Loads: Determine loads based on the following minimum design wind pressures:
      a. Uniform pressure of 30 lbf/sq. ft. (1436 Pa), acting inward or outward.
   2. Deflection Limits: Metal-faced composite wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/175 of the span at the perimeter and 1/60 of the span anywhere in the panel of the span.

C. Air/Water System Test Performance:
   1. Air Infiltration: In accordance with ASTM E283, air infiltration at 1.57 psf not to exceed 0.06 cfm/ft² of wall area.
   2. Water Penetration: No water infiltration beyond weather barrier under differential static pressure of 6.24 psf after 15 minutes of exposure in accordance with ASTM E311.
   3. Dynamic Water Infiltration: Comply with AAMA 501 Dynamic Water Infiltration Test requirements.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include product test reports.

B. Shop Drawings: Show fabrication and installation layouts of metal-faced composite wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.

C. Samples: For each type of exposed finish required.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Warranty as specified elsewhere in this Section.
1.5 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where indicated, provide metal-faced composite wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Preinstallation Conference: Conduct conference at Project site.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-faced composite wall panel assemblies that fail in materials or workmanship within specified warranty period.
   1. Material Warranty Period: 10 years from date of Substantial Completion.
   2. Workmanship Warranty Period: 2 years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal-faced composite wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMPOSITE WALL PANELS

A. General: Provide factory-formed and -assembled, metal-faced composite wall panels fabricated from two metal facings bonded, using no glues or adhesives, to solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.
   1. Fire-Retardant Core: Noncombustible, with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.
   2. Approved Systems:
      a. Seiccoline II Rear Ventilated Rain Screen System as manufactured by SGH Architectural Products.
      b. Series 20 Spline Reveal Drained and Back Ventilated Rain Screen System as manufactured by Metal Design Systems.

B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- (0.50-mm-) thick, coil-coated aluminum sheet facings.
   1. Panel Thickness: 0.156” (4 mm)
   2. Exterior Finish:
      a. Color 1: Mica MNC as manufactured by Alpolic.

C. Attachment System Components: Formed from extruded aluminum.
   1. Include manufacturer's standard perimeter extrusions with integral weather-stripping panel stiffeners panel clips and anchor channels.
2.2 MISCELLANEOUS MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).

B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal-faced composite wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.3 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal-faced composite wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.

B. Flashing and Trim: Formed from 0.018-inch- (0.46-mm-) minimum thickness, 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, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal-faced composite wall panels.

2.4 FABRICATION

A. General: Fabricate and finish metal-faced composite wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal-faced composite wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Metal-Faced Composite Wall Panels: Factory form panels in a continuous process with no glues or adhesives between dissimilar materials. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
   1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
   2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
   3. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
   4. Dimensional Tolerances:
      a. Panel Bow: 0.8 percent maximum of panel length or width.
      b. Squareness: 0.25 inch (5 mm) maximum.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal-faced composite wall panel manufacturer's written instructions.

3.2 METAL-FACED COMPOSITE WALL PANEL INSTALLATION

A. Attachment System Installation, General: Install attachment system required to support metal-faced composite wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
   1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
   2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.

B. Rainscreen-Principle Installation: Provide manufacturer's standard pressure-equalized, rainscreen-principle system with vertical channel that provides support and complete secondary drainage system, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach wall panels by engaging horizontal support pins into notches in vertical channels and into flanges of wall panels. Leave horizontal and vertical joints with open reveal.
   1. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
   2. Do not apply sealants to joints unless otherwise indicated on Drawings.

3.3 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal-faced composite wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal-faced composite wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal-faced composite wall panels are installed unless otherwise indicated in manufacturer's written installation
instructions. On completion of metal-faced composite wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.

B. After metal-faced composite wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION 07 42 43
SECTION 07 54 00
FULLY-ADHERED THERMOPLASTIC (TPO) MEMBRANE ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES
A. Thermoplastic Polyolefin Membrane Roofing (TPO).
B. Membrane Flashings.
C. Metal Flashings.
D. Roof Insulation.
E. Roof Cover board.

1.2 RELATED SECTIONS
A. Section 06 10 00 - Rough Carpentry.
B. Section 07 62 00 - Sheet Metal Flashing and Trim.
C. Section 07 92 00 - Joint Sealants.
D. Section 07 95 00 - Expansion Joint Covers.

1.3 REFERENCES
A. American Society of Civil Engineers (ASCE) - ASCE 7 - Minimum Design Loads for Buildings and Other Structures, Current Revision.
B. ANSI/SPRI WD-1 “Wind Design Standard for Roofing Assemblies”.
C. Factory Mutual (FM Global):
   1. Approval Guide.
      b. Loss Prevention Data Sheets 1-28, 1-29.
D. International Code Council (ICC):

1.4 DESIGN CRITERIA
A. Wind Uplift Performance:
   1. Roof system is designed to withstand wind uplift forces as calculated using the current revision of ASCE-7.
   2. Roof system is designed in accordance to an FM I-105 wind uplift rating.
B. Fire Resistance Performance:
   1. Roof system will achieve a UL Class A rating when tested in accordance with UL-790.

C. Drainage: Provide a roof system with positive drainage where all standing water dissipates within 24 hours after inclement weather and precipitation.

D. Building Codes:
   1. Roof system will meet the requirements of all federal, state and local code bodies having jurisdiction.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer’s data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Sample of Specified 30 Year Warranty and 5 Year Maintenance Extension.
   4. Installation methods.

C. Detail Drawings:
   1. Submit approved plan, section, elevation or isometric drawings which detail the appropriate methods for all flashing conditions found on the project.
   2. Coordinate approved drawings with locations found on the Contract Drawings.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of Twenty (20) years experience.

B. Weekly Quality and Progress Inspections may be provided by an independent non-interested third-party consultant. Inspections will be conducted for the sole purpose of communicating quality and installation progress information to the owner or owner’s representative.

C. Manufacturer’s Representative to provide an inspection at the start of membrane installation, an additional in progress inspection of the roof assembly at approximately 30% completion, and 60% completion, and a final inspection of the roof assembly upon the completion of the roof system installation.

D. Qualified Manufacturer’s Representative will be an IBEC-RCI accredited Registered Roof Observer (RRO) In Good Standing.

E. Manufacturer’s Representative is to be a non-sales person.

F. A qualified manufacturer that has UL listing and FM Global approval for roofing system identical to that used for this project.

G. Installer Qualifications:
   1. All products listed in this section are to be installed by a single installer with a minimum of fifteen (15) years demonstrated experience in installing products of the same type and scope as specified.
   2. Installer to be a licensed GAF Master Select Contractor.
   3. Installer must be an MRCA (Midwest Roofing Contractors Association) or IRC (Iowa...
4. Installer must be capable of extending the Manufacturer’s 35 Year No Dollar Limit Guarantee.

H. Mock-Up: Provide a mock-up at the designer’s request, for evaluation of surface preparation, installation techniques and workmanship.
   1. Finish areas designated by Designer / Owner’s Representative.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect or Building Owner Representative.
   3. Mock-up may be part of the finished Work if approved by the Architect and/or Owner’s Representative. Otherwise, refinish mock-up area as required to produce acceptable work.

I. Pre-installation Conference: Conduct conference at Project site to review methods and procedures related to roofing system, but not limited to the following:
   1. Meet with Owner, Architect, Owner’s Representative, Consultant if applicable, roofing installer, roofing system manufacturer, 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 base flashing details, any special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect the roofing system.
   6. Overview of safety procedures shall be the responsibility of the General Contractor and/or Owner.

1.7 DELIVERY, STORAGE, AND HANDLING

A. All delivered materials are to be clearly labeled with the material manufacturer’s factory label visible. Store products in unopened packaging until ready for installation.

B. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

C. Material Safety Data Sheets (MSDS) must be on location at all times during the transportation, storage and application of materials.

D. When loading materials onto the roof, the Roofing Applicator must comply with the requirements of the building owner to prevent overloading and possible disturbance to the building structure.

E. Materials and equipment are to be stored, and isolated to a single area of the jobsite to ensure minimal disruption to building and occupants.
1.8 PROJECT CONDITIONS

A. Proceed with roofing work only when weather conditions are in compliance with the manufacturer’s recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer’s requirements and recommendations.

B. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.

C. Provide protection, such as ¾ inch thick plywood or 1” isocyanurate, for all finished roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.

D. The surface on which the insulation and roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.

E. New roofing shall be complete and weather tight at the end of the work day.

F. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

1.9 WARRANTY

A. At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's Total System NDL type Warranty, non-prorated with no dollar limit to coverage; outlining its terms conditions, and any exclusion from coverage.

1. Duration: 35 Years.
2. Installing Contractor to provide Total System Warranty for the first 2 years of roof service.
3. Warranty Extension: The Membrane Manufacturer guarantees to the original or first subsequent owner that coverage shall be extended by 25% of the original guarantee length at no cost, provided that the roof is inspected and maintained annually. According to the MAINTAINENCE section of this specification.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. All products are to be furnished from U.S. Manufacturing plants and be provided by material manufacturers wholly owned, operating, and headquartered in the United States of America, without exclusions for foreign based companies operating in the U.S under LLCs.

1. Basis of Design: GAF Materials Corporation, Parsippany, NJ 07054

2.2 SCOPE / APPLICATION

A. Roof System: Provide a waterproof roof system, capable of withstanding uplift forces as specified in the Design Criteria article of this section.

1. Membrane Attachment: Manufacturer's standard roller or sprayable solvent-based bonding adhesive.
2. Provide roof insulation, cover board and vapor barrier system beneath the finish membrane.
B. Base Flashing: Provide a waterproof, fully adhered base flashing system at all penetrations, plane transitions and terminations.

2.3 THERMOPLASTIC POLYLEFIN (TPO) MEMBRANE

A. Basis of Design: GAF EVERGUARD EXTREME TPO MEMBRANE. A High-Performance flexible TPO membrane reinforced with a non-woven polyester based scrim reinforcement. Exceeding the requirements of ASTM D 6878 for thermoplastic membranes.

1. Membrane Thickness: 60-mil actual thickness (membrane manufacturer to document and certify thickness in writing).
3. Heat Age Testing: Documented testing at 275°F for 200 Days with less than 1.5% weight loss and no signs of cracking.
4. Field Sheet Dimensions:
   a. Width: 10 feet (3.05 m) maximum.
   b. Length: 100 feet (30.5 m) maximum.

2.4 COVER BOARD

A. Cover Board: Manufacturers standard High Density Polyiso Cover Board: 100 psi. density isocyanurate foam core with coated glass facers on both sides. Meeting or exceeding the requirements of UL 790, ASTM E 108, and classified for severe hail impact by Factory Mutual Global.

1. GAF EnergyGuard High Density Polyiso Cover Board.
2. Iso Board Thickness: 1/2 inch.
3. Minimum R Value: 2.5 R

2.5 ROOF INSULATION

A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 3 (25 psi) felt or glass-fiber mat facer on both major surfaces.

1. Install two (2) layers of 2.5-inch thick polyisocyanurate insulation as base layers of insulation, unless noted otherwise. Stagger joints between layers in both directions. Butt joints of layers tight.

B. Tapered Insulation: Provide factory-tapered insulation boards, fabricated to slope indicated on Drawings.

C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

D. Insulation Accessories:

1. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

2.6 VAPOR BARRIER

A. Basis of Design: GAF Liberty SBS Self-Adhering Base/Ply Sheet, ASTM D6163, Type 1.

1. Minimum Thickness: 70 mils.
3. Tensile Strength (ASTM D5147): 70 lbf/in.
4. Elongation (ASTM D5147): 1%.
5. Low Temperature Flexibility (ASTM D5147): 0 degrees F.
7. Dimensional Stability (ASTM D5147): 0.5%.

B. Vapor barrier shall be continuous, from parapet to parapet, over corrugated metal roof decking. Install per manufacturer’s written installation instructions.

2.7 ACCESSORIES

A. Inside Corners: Pre-molded corner flashing for inside corners. 80 mil thickness.
B. Outside Corners: Injection molded corner used for flashing outside corners. 80 mil thickness.
C. TPO T-Joint Covers: TPO formed into a circle used to seal step-offs at splice intersections. 55 mil thickness.
D. TPO Curb Wrap Corners: Pre-fabricated corner flashings made from 45 mil thick reinforced TPO membrane. 6 inch (152mm) wide base flange and a 12 inch (305mm) overall height.
E. Molded Vent Boots: A pre-molded flashing and clamping ring used for pipe penetrations. 75 mil thickness. Available for 0.75 inch to 8 inch (19 – 203.2mm) diameter pipes.
F. Split Pipe Boots: Pre-fabricated flashing consisting of 45 mil thick reinforced TPO Membrane for pipes 1 inch to 6 inch (25.4 – 152.4mm) in diameter. A split (cut) and overlapped tab is incorporated to allow the pipe seal to be opened and wrapped around the pipe when it is not possible to pull a standard pipe flashing over a round penetration.
G. TPO Square Tubing Wraps: Pre-fabricated flashings made of 45 mil thick reinforced TPO membrane for square tubing. A split (cut) and overlap tab are incorporated into these parts to allow the seals to be opened and wrapped around a square tubing penetration with an obstruction. Stock sizes include 3- inch, 4-inch, 5-inch and 6 inch (76, 102, 127, 152 mm) diameter square tubing.
H. TPO Molded Penetration Pockets:
   1. A one-piece, 70 mil thickness, injection molded, flexible pocket with a stiff vertical wall and pre-formed deck flanges. Color to match membrane.
   2. Used with Thermoplastic 1-Part Pourable Sealer as specified in this section for waterproofing pipe clusters or other odd shaped penetrations. Color: White.
I. TPO Heat-Weldable Walkway Rolls (Walkway Pad): Diamond tread, non-slip design. Superior tear, puncture and weather resistance and designed to protect membrane in those areas exposed to repetitive foot traffic or other hazards. Walkway material may be heat welded directly to TPO membrane using an automatic heat welder or hand held heat welder. Color: Safety Yellow. Provide walkway pad around all roof hatches, roof top units and other roof equipment requiring regular maintenance, and at all locations noted on the drawings. Coordinate with the owner for final placement of walkway pads prior to bidding.
J. UN-55 Detailing Membrane: Non-reinforced Extreme Formulated TPO flashing is a 55-mil thick non-reinforced TPO based membrane used for detail work where the use of pre-molded or pre-fabricated accessories are not feasible. Color: White.
K. Termination Bars:
   1. Type: Channel or Lip Bar.
3. Holes: Spaced at regular intervals for fastening as recommended by the manufacturer for each location.
4. Thickness: .090 minimum.

2.8 CLEANERS, PRIMERS, ADHESIVES AND SEALANTS

A. TPO Cut Edge Sealant: A medium solids content, free flowing polymeric material designed for sealing cut edges (exposed fabric reinforcement) of reinforced field membrane.

B. Water Block: A one-component, high viscosity, Butyl based mastic used as a compression sealing agent between membrane and applicable substrates.

C. TPO Primer: Solvent-based product designed to prepare TPO membrane for improved adhesion to surfaces prior to the application of pressure-sensitive products and sealant pockets.

D. TPO Seam Cleaner: Clear, solvent-based cleaner used to loosen and remove contaminants from the surface of exposed membrane prior to heat welding aged or dirty material.

E. FlexSeal Caulk Grade: A high viscosity elastomeric sealant specifically designed to adhere to TPO membranes, used to seal the exposed lip of compression fittings such as termination bars, pipe clamping rings, and exposed fasteners.

2.9 MEMBRANE ADHESIVE

A. Fully Adhered TPO System.
   1. Manufacturer’s standard 2-sided contact adhesive or sprayable solvent based-bonding adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify that the surfaces and site conditions are ready to receive work.

C. Verify that the deck and/or substrate is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.

D. Verify that the deck and/or substrate surfaces are clean, dry, and free of ice or snow.

3.2 SUBSTRATE PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Do not commence work until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment.
3.3 INSULATION PLACEMENT

A. Do not install wet, damaged or warped insulation boards.

B. Stagger joints in one direction unless joints are to be taped. Install insulation boards snug. Gaps between board joints shall not exceed 1/4 inch (6 mm). Fill all gaps in excess of 1/4 inch (6 mm) with expanding foam.

C. Wood nailers must be at least 3 1/2 inches (89 mm) wide or 1 inch (25 mm) wider than adjacent metal flange. Thickness must equal that of insulation but not less than 1 inch (25 mm) thickness.

D. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.

E. Do not install any more insulation than will be completely waterproofed each day.

F. Phased installation of the roof system will not be allowed.

3.4 INSULATION / COVER BOARD ATTACHMENT

A. Securely attach insulation and cover board to the roof deck using manufacturer's recommended fasteners. Attachment must have been successfully tested to meet or exceed the calculated uplift pressure required by the International Building Code (ASCE-7) or ANSI/SPRI WD-1.

B. Install Cover Board maximum 4 feet by 8 feet anchored in place with manufacturer's recommended fasteners. Fastening rates are to conform to membrane manufacturer's recommendations for a fully adhered roof system.

C. Fasteners shall not penetrate the lower, exposed portion of roof decking in areas with acoustical decking. Fasteners shall penetrate the upper rib, but shall not be exposed to view from below the roof decking.

3.5 MEMBRANE PLACEMENT AND ATTACHMENT

A. Position TPO membrane over the acceptable substrate, and allow the membrane to relax so that it lays completely flat.

B. Carefully fold the membrane back exposing the backing.

C. Apply manufacturer's standard solvent-based bonding adhesive to the substrate and membrane. Apply per manufacturer's written instructions.

D. After the adhesive has properly flashed, the membrane should be firmly set onto the substrate. The membrane should be rolled with a weighted roller to properly mate the membrane to the adhesive.

E. Position adjoining sheets to allow a minimum overlap of 2 inches, and repeat the bonding procedure.

F. Hot-air weld the TPO membrane sheets using the Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's hot air welding procedures.
G. Continue to install adjoining membrane sheets in the same manner, overlapping edges a minimum of 2 inches and complete the bonding procedures as stated previously.

3.6 SEAM WELDING

A. Hot-air weld membrane using an Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's current guidelines. At all splice intersections, roll the seam with a silicone roller to ensure a continuous hot air welded seam.

B. Overlay all splice intersections with a T-Joint Cover.

C. Probe all seams once the hot air welds have thoroughly cooled (approximately 30 minutes). Seams should be checked the same day the material is welded. Take care not to damage the membrane while probing.

D. Repair any seam deficiencies the same day they are discovered.

E. Apply Cut Edge Sealant on all cut edges of reinforced membrane (where the scrim reinforcement is exposed) after seam probing is complete. Cut Edge Sealant is required on vertical splices.

3.7 FLASHING

A. Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using reinforced TPO membrane or prefabricated accessories. Non-reinforced membrane may be used for flashing pipe penetrations, and scuppers, as well as inside and outside corners, when the use of pre-molded or prefabricated accessories is not feasible.

B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.
   1. Mechanical securement (Base Tie-In) is required at all curbs, parapet walls, knee walls and similar angle change conditions.

3.8 WALKWAYS

A. Install manufacturer's standard non-slip, weldable walk pad at all roof access points and areas of traffic concentration (such as roof hatches, access doors, rooftop ladders, etc.) and all additional locations as identified on the Contract Drawings.

B. Hot-air weld walkway pads to the membrane in accordance with the manufacturer's current application guidelines.

3.9 NIGHTTIME SEALS

A. When the completion of flashings and terminations is not achieved by the end of the work day, a daily night seal must be installed to temporarily close the membrane to prevent water infiltration.

B. Complete an acceptable membrane seal in accordance with the manufacturer's requirements. The use of Butyl, Hot Asphalt, or Bentonite Clay for use as a Nighttime seal will not be permitted.
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3.10 CLEAN UP

A. Perform daily clean-up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.

B. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking, counter flashings, and terminations.

3.11 PROTECTION

A. Protect installed products until completion of project.

B. The installation of protection boards for use as temporary walk areas is required when crossing over completed roof areas, as set forth in PROJECT CONSIDERATIONS.

C. Touch-up, repair or replace damaged products before Substantial Completion.

D. Clean and restore all damaged surfaces to their original condition.

3.12 MAINTENANCE

A. Inspections to the roof shall be performed annually by an authorized professional / contractor.

B. Damage noted is to be reported to the membrane manufacturer immediately.

C. The Membrane Manufacturer agrees to extend the warranty period by 25% at no charge to the building owner, if annual roof inspections are completed by an authorized roofing professional.

END OF SECTION 07 54 00
SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manufactured sheet metal flashing and counterflashing.
   2. Aluminum Sheet.
   3. Copings.
   4. Sill flashing.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Submit types of fasteners to be used at vertical, horizontal, and exposed areas.

B. Shop Drawings: Show installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
   1. Include details for forming, joining, supporting, and securing sheet metal flashing and trim, including pattern of seams, termination points, fixed points, expansion joints, expansion-joint covers, edge conditions, special conditions, and connections to adjoining work.

C. Samples: For each exposed product and for each finish specified.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Warranty as specified elsewhere in this Section.

1.5 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

B. Provide manufactured roofing specialties, incorporating roof edge treatment that complies with recommendations of FM Loss Prevention Data Sheet 1-49 for the following Wind Zone:
   1. Wind Zone 1: Wind pressures of 10 to 20 lbf/sq. ft.
   2. Wind Zone 1: Wind pressures of 21 to 30 lbf/sq. ft.
   3. Wind Zone 2: Wind pressures of 31 to 45 lbf/sq. ft.
   4. Wind Zone 3: Wind pressures of 46 to 104 lbf/sq. ft.
1.6 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

B. 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 of typical sill flashing and fascia, approximately 10 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
   2. Mockup, if accepted, may remain as part of the work.

C. Preinstallation Conference: Conduct conference at Project site.

1.7 WARRANTY

A. Special Warranty: Ten year warranty on materials and workmanship.

B. 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 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 RECYCLED CONTENT

A. Products specified in this section contribute to the project-wide requirements for Recycled Content described in Section 0 81 13.14 "Sustainable Design Requirements".

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required, .050” thick.
   1. Exposed Coil-Coated Finishes:
      a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
      b. Color: As selected by Architect from manufacturer's full range.

C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation prepainted by coil-coating process to comply with ASTM A 755/A 755M. Finish and color apply to all prefinished galvanized steel materials noted in this section.
   1. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides.
   2. Exposed Coil-Coated Finish:
      a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      b. Color: As selected by Architect from manufacturer's full range.
   3. Colors:
      a. Color 1: Silver Metallic as manufactured by Firestone.
      b. Color 2: Charcoal Gray as manufactured by Firestone.
c. Other colors as selected by Architect from Manufacturer’s full range.

4. Concealed Finish: Pretreat with manufacturer’s standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

D. Roof Edge Flashing and Fascia Cap: Fabricate in minimum 10-feet long, but not exceeding 12-feet long sections.
1. Fabricate from the following materials: 22-gauge prefinished galvanized steel.

E. Prefinished Metal Parapet Coping:
1. Fabricate from the following materials: 22-gauge galvanized steel.
2. Accessories: provide fully-welded corner coping pieces at all parapet corners.

F. Base and Sill Flashing:
1. Fabricate from the following materials: 22-gauge prefinished galvanized steel.

G. Counterflashing and Flashing Receivers:
1. Fabricate from the Following Materials: 22-gauge prefinished galvanized steel unless noted otherwise.

H. Custom fabricated brake metal profiles:
1. Fabricate from the following materials: 22-gauge prefinished galvanized steel unless noted otherwise.

2.3 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.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.

2.4 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.
1. General: Blind fasteners or self-drilling screws, gasketed. Use hex-washer heads at areas not exposed to view.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Fasteners as approved by Architect. Limit use of exposed fasteners to vertical surfaces only.
   b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. 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 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.

2.5 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. Obtain field measurements for accurate fit before shop fabrication.

2. 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.

3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

C. 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.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. 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.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. 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. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over 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. Limit the use of exposed fasteners to vertical surfaces. Provide gasketed fasteners.

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 and metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.
3.3  ROOF DRAINAGE SYSTEM INSTALLATION
   A. General: Install sheet metal roof drainage items to produce complete roof drainage system
      according to SMACNA recommendations and as indicated. Coordinate installation of roof
      perimeter flashing with installation of roof drainage system.
   B. Refer to drawings and specification section 074100 - MANUFACTURED METAL ROOFING
      PANELS – LOW SLOPE for more information.

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. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in
      SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof
      edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
   C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top
      edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install
      stainless-steel draw band and tighten.
   D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
      Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend
      counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches
      and bed with sealant.
   E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of
      roofing and other items penetrating roof. Seal with sealant and clamp flashing to pipes that
      penetrate roof.

3.5  WALL FLASHING INSTALLATION
   A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according
      to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with
      installation of wall-opening components such as windows, doors, and louvers.
   B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04 Section
      "Unit Masonry."

3.6  CLEANING AND PROTECTION
   A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
      Clean and neutralize flux materials. Clean off excess solder and sealants.
   B. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are
      installed unless otherwise indicated in manufacturer’s written installation instructions.

END OF SECTION 07 62 00
SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Roof hatches.
   2. Roof hatch safety rail system and ladder extension system.

1.2 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include certificates indicating products meet or exceed specified requirements.

B. Shop Drawings: Show fabrication and installation details for roof accessories.

C. Samples: For each type of exposed factory-applied color finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data

B. Warranty as specified elsewhere in this Section.

1.4 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA’s “Architectural Sheet Metal Manual” details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

B. Manufacturer Requirements: Company specializing in manufacturing products specified in this section with not less than two (2) years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer’s original packaging.

B. Store products under cover, dry, and elevated above grade.

1.6 WARRANTY

A. Roof Hatch Safety Rail:
   1. Provide manufacturer’s warranty against defects in material and workmanship for roof hatch safety rail for eight (8) years from date of purchase.
   2. Three (3) year powder-coat finish limited warranty.
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, manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated and mill phosphatized for field painting.

2.3 ROOF HATCHES

A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated double-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.
1. Basis of Design: Roof Hatch, Personnel Access, model #BRHPB as produced by Babcock-Davis. Substitutions allowed in accordance with Division 00 of the project specification.
3. Type and Size: Single-leaf lid, 30-inches by 36-inches.
5. Lid Material: 11 ga aluminum stiffened to withstand load indicated above.
6. Insulation: 1" polystyrene board insulation (R4 min) in cover, and 1" fiberboard (R2.8 min) in curb.
7. Interior Lid Liner: 18 ga aluminum to match cover.
8. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
9. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
10. Hardware: Stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside. Hold open arm shall lock cover into fully open position and shall be constructed of zinc-plated steel with vinyl grip handle.

2.4 LADDER EXTENSION SYSTEM

A. Basis of Design: Ladder Safety Post Model No. BSP as manufactured by Ba
1. Description: 1-1/2" x 1-1/2" x 1/8" high strength square tubing with a pull up loop provided at the upper end to facilitate raising of post.
5. All associated components shall be manufacturer's standard to provide full and complete system.
2.5 FALL ARREST ANCHORS

A. Basis of Design: CRA Threaded Top Anchor and Riser as manufactured by Super Anchor Safety; 17731 – 147th Street SE Monroe, WA 98272; Ph: (855) 301-4575; https://superanchor.com/
   1. Part Number: 1482-G.
   2. Riser Height: 24-inches.
   6. Safety line: Provide
      a. Basis of Design: 3M DBI-SALA Sayfline Multi-Span Horizontal Cable Lifeline System.
      b. Mount safety line attachment plate to top side of fall arrest anchor riser with bolted connection. Contractor shall confirm that components are compatible.
      c. Install sealant between fall arrest anchor riser and safety line mounting plate to prevent water intrusion into riser.
      d. Cable length to be field verified.

B. Fall Arrest Anchor Installation:
   1. Mount fall arrest anchor base plate to top surface of corrugated metal roof decking at locations shown on drawings. Field verify that there are no obstructions that will impede installation of anchor or steel backer plate. Confirm locations with architect prior to installation.
   2. Provide 3/8-inch (minimum) thickness steel backer plate below roof decking. Bolt fall arrest anchor base plate through decking into steel backer plate per manufacturer's written installation instructions.
   3. Provide 2-inch (minimum) thick layer of spray-applied foam insulation below all fall arrest anchor mounting locations. Spray-applied foam insulation shall extend 8-inch minimum past edge of steel backer plate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Report to the Contractor in writing, defects of work prepared by other trades and other unsatisfactory site conditions. Verify site dimensions. Commencement of work will imply acceptance of prepared work.

B. Verify roof hatch is suitable to receive proper installation of safety rail and ladder extension system. Report unsatisfactory conditions to Architect. Proceeding with work acknowledges satisfactory conditions.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.
C. Install safety rail and ladder extension system by through-bolting to integral curb flashing of roof hatch, avoiding penetration of roof base flashing.

D. 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 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 exposed-to-view components of 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 underlayment.

E. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

F. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

### 3.3 FIELD QUALITY CONTROL

A. All roof anchor work to be inspected by a qualified testing agency or Professional Engineer upon completion of work.

### 3.4 ADJUSTING AND FINAL INSPECTION

A. Verify all manufactured units have been installed with accordance with specifications and details and will function as intended. Adjust items where necessary to ensure proper operation, gate to move without binding.

### 3.5 CLEANING

A. Clean manufactured units using materials and methods approved by manufacturer. Do not use cleaners or techniques which could impair performance of roof accessories.

**END OF SECTION 07 72 00**
SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sealants for the following applications, including those specified by reference to this Section:
   1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
      a. Control and expansion joints in brick and concrete unit masonry.
      b. Perimeter joints between materials listed above and frames of doors and windows.
      c. For control and expansion joints in precast concrete.
      d. Joints in metal panels.
      e. Joints in fiber cement wall panels, fascia boards, and trim boards at exterior.
      f. Other joints as indicated.
   2. Exterior joints in the following horizontal traffic surfaces per SUDAS:
      a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
      b. Joints between different materials listed above.
      c. Joints in EIFS at exterior soffits.
      d. Joints in wall panels and fiber cement panels at exterior soffits.
      e. Other joints as indicated.
   3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Vertical control joints on exposed surfaces of interior unit masonry walls and partitions.
      d. Perimeter joints between interior wall surfaces and frames of interior doors, and windows.
      e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      f. Other joints as indicated.
   4. Interior joints in the following horizontal traffic surfaces:
      a. Control and expansion joints in cast-in-place concrete slabs.
      b. Other joints as indicated.

1.2 PERFORMANCE REQUIREMENTS

A. Provide silicone and 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.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
   1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
   2. Conduct field tests for each application indicated below:
      a. Each kind of sealant and joint substrate indicated.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 SUBMITTALS
A. Product Data: For each joint-sealant product indicated.
B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each product exposed to view.
C. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

1.5 LEED SUBMITTALS
A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 "Sustainable Design Requirements".

1.6 MOCKUPS
A. Exterior Sealant Joints
   1. Provide up to four (4) mockups of exterior sealant joint for review of color selection and workmanship for each type of face brick veneer.
      a. Mockup sealant joint shall be 4'-0" tall minimum. Face brick veneer mockup panel may be utilized for mockup review.
      b. Rejected mockups shall be fully removed, and the joint cleaned prior to final exterior sealant joint installation.
B. Interior Sealant Joints
   1. Provide mockup of all interior sealant joint types for review of color and workmanship. Sealant joint types may include, but not be limited to the following:
      a. Wall-to-window and wall-to-door frame jamb and head connection.
      b. Window sill-to-window connection.
      c. Wall-to-wall connection.
      d. Wall-to-floor connection.
1.7 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. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

C. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.8 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.

1.9 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 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.

1.10 CLOSEOUT SUBMITTALS/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 silicone and 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.

C. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish silicone and elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period:
   a. Urethane: 5 years from date of Substantial Completion.
   b. Silicone: 20 years from date of Substantial Completion

D. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 "Sustainable Design Requirements".

2.2 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.

B. Acceptable Manufacturers – sealants:
   1. Master Builders Solutions, a division of BASF.
   2. General Electric.
   3. Dow Corning.
   4. Pecora.
   5. Sika.
   6. Tremco.
   7. United States Gypsum.

2.3 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.

2.4 SILICONE AND ELASTOMERIC JOINT SEALANTS

A. Silicone and Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Silicone and Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
B. Stain-Test-Response Characteristics: Where sealants are specified in the Silicone and 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.

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. Closed cell polyethylene rod designed for use with cold applied joint sealants.

C. Silicone and 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. 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.

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. 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 C1193, unless otherwise indicated.

3.4 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.

3.5 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.

3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE
A. Listed Manufacturer's products are representative examples.

B. Sealant Type 1: Acoustical Sealant
1. Top and bottom of interior partition walls.
   a. Fully seal around penetrations on non-rated interior partition walls.
2. ASTM C-919, one part acrylic latex equivalent to Tremco "Acoustical Sealant".

C. Sealant Type 2: Acrylic latex sealant
1. Typical use:
   a. Typical interior sealant applications, unless noted otherwise.
2. ASTM C834 for latex sealing compounds.
3. Joint movement capability: ± 7.5%
4. Equivalent to Tremco "Tremflex 834".

D. Sealant Type 3: Urethane sealant, one component
1. Typical use: Painted exterior sealant joints. Use sealant type 6 for non-painted exterior sealant joints.
2. ASTM C-920, equivalent to Master Builders Solutions MasterSeal "NP1" or Tremco "Dymonic FC".

E. Sealant Type 4: Urethane sealant, self-leveling
1. Typical use:
   a. Horizontal joints in stoops, sidewalks and concrete slabs. Refer to Civil documents
      for pavement joint sealant.
   b. Refer to specification section 03 35 43 – Polished Concrete Floors for sealant
      joints in polished concrete floor slabs, if applicable.
2. ASTM C-920, Type M, Grade P, Class 25, uses T, M, O.
3. Joint movement capability: ± 25%.
4. Equivalent to Tremco “THC 900/901”.

F. Sealant Type 5: Silicone sealant
1. Typical use:
   a. Around plumbing fixtures.
2. Equivalent to Tremco “TremPro 644 RTV”.

G. Sealant Type 6: Field tintable silicone sealant
1. Typical use:
   a. All exterior joints and penetrations.
2. ASTM C-920, Type M, Grade NS, Class 50, uses NT, G, M, A, O.
3. Joint movement capability: ± 50%.
4. Equivalent to Tremco “Spectrem 4-TS”
   a. Provide Tremco “Spectrem 1” at HDPE and polyethylene conditions.

H. Sealant Type 7: One-component, aliphatic, nonsag, elastomeric, polyurethane security sealant
1. Typical use:
   a. Interior joints required to be pick-resistant, as noted on drawings.
2. ASTM C 920, Type S, Grade NS, Class 25, uses NT, T, M, A, and I.
3. Joint movement capability: ± 25%.
4. Equivalent to Master Builder Solutions Sonolastic “Ultra”.

I. Sealant Type 8: Urethane sealant, one component
1. Typical use:
   a. 2” building expansion joints as noted on drawings.
2. ASTM C920, Type S, Grade NS, Class 100/50, Uses NT, M, A, O and 1 (Class 2).
3. Joint movement capability: +100%/- 50-%
4. Sealant dimensions in joint: 2” wide x 1” deep.
5. Backing material: Closed-cell backer rod.
6. Equivalent to Tremco “Dymonic 100”.

J. Sealant Type 9: Moisture-curing polyether sealant
1. Typical use:
   a. Face-brick veneer thru-wall flashing termination bar. Refer to specification section
      04 20 00 – Unit Masonry.
2. ASTM C920, Type S, Grade NS, Class 25, Uses NT, T, M, G, A & O
3. Joint movement capability: 25%
4. Equivalent to Hohmann & Barnard HB Sealant.

K. Backer Rod
1. Typical use:
   a. At all sealant joints requiring supporting backer rod.
2. Provide closed-cell polyethylene rod designed for use with cold applied joint sealants.
3. Provide backer rod of size required for joint design.
L. Joint Filler
   1. Typical use:
      a. Sealant Type 4.
   2. Provide closed-cell polyethylene joint filler designed for use with cold applied joint sealants.
   3. Provide joint filler of size required for joint design.

M. Preformed Silicone Joint Seals: Manufacturer's standard seal consisting of precured low-modulus silicone extrusion, in sizes to fit applications indicated on Drawings, combined with a neutral-curing liquid silicone sealant for bonding seals to substrates.
   2. Shore A hardness ASTM D2240: 29-32
   3. Tensile strength ASTM D412: 218 psi
   4. Elongation at break ASTM D412: 554%
   5. Movement classification ASTM C1523: Class 200%
   6. Tear propagation classification ASTM C1523: PT (partial tear)

N. Color of sealants will be selected by the Architect from the manufacturer's full color range if color has not been indicated herein.

END OF SECTION 07 92 00
SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Standard hollow metal doors and frames, typical at all interior openings where hollow metal doors and frames are noted.
   2. Thermally-broken hollow metal doors and frames, typical at all exterior openings where hollow metal doors and frames are noted.

1.2 SUBMITTALS

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

B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.

C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

B. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

   1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
   2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
   3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
   4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
   5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
   6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
1.4 QUALITY ASSURANCE

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure as close to neutral pressure as possible according to NFPA 252.
   1. Temperature-Rise Limit: provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

B. Fire-Rated, Door Lite and Borrowed Lite Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

C. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

D. Thermally Broken Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
   1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
      a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.36, R-Value 2.78, including insulated door, thermal-break frame and threshold.
   2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
      a. Rate of leakage of the door assembly shall not exceed 0.1 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).

   1. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

PART 2 - PRODUCTS

2.1 MATERIAL OPTIMIZATION

A. Products specified in this section have been identified to have a published Environmental Product Data (EPD) Declaration and/or and published Material Ingredient (HPD+). Project-wide requirements are described in Section 01 81 13.14 “Sustainable Design Requirements”.
2.2 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.3 RECYCLED CONTENT

A. Products specified in this section contribute to the project-wide requirements for Recycled Content described in Section 0 81 13.14 “Sustainable Design Requirements”.

2.4 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. Ceco Door Products; an Assa Abloy Group company.
   2. Curries Company; an Assa Abloy Group company.
   3. Substitutions: Allowed in accordance with Section 00 26 00.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Spray-Applied Foam Insulation for door frames in metal-stud partition walls:
   1. Acceptable Products:
      a. E84 Class 1 Fire Retardant Spray Foam Insulation as manufactured by Handi-Foam.
      b. GacoFireStop 5500 as manufactured by Gaco Western.
      c. Substitutions: Allowed in accordance with Section 00 26 00.

G. Glazing: Division 08 Section “Glazing.”

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.

2.6 STANDARD HOLLOW METAL DOORS

A. General: Comply with ANSI/SDI A250.8.
   1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core. Where indicted provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
   a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.

B. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).


2.7 THERMALLY-BROKEN HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design specified, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Products:
1. Ceco Door 1-3/4” Trio-E.
2. Substitutions: Allowed in accordance with Section 00 26 00.

C. Location: Typical at all exterior openings with hollow metal doors.

D. Thermally Broken Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.
1. Design: Flush panel.
   a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly.
   b. Thermal properties to rate at a fully operable minimum U-Factor 0.29 and R-Value 3.4, including insulated door, thermal-break frame and threshold.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge thick steel, Model 2.
4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled lock edge, 1/8 inch in 2 inches (3mm in 50mm).
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending to the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
8. Finish: Paint to match aluminum composite panel finish. Refer to specification section 074243 – Aluminum Composite Panels for more information.

2.8 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8.

   1. Fabricate frames with mitered or coped corners.
   2. Fabricate frames as full profile welded unless otherwise indicated.
   3. Frames for Level 3 Steel Doors: 0.053-inch- thick steel sheet.
   4. Minimum Thermal Performance: U-Factor of 0.8 maximum in accordance with ASTM C1363.

C. Interior Frames: Fabricated from cold-rolled steel sheet.
   1. Fabricate frames with mitered or coped corners.
   2. Fabricate frames as full profile welded unless otherwise indicated.
   3. Frames for Level 3 Steel Doors: 0.053-inch- thick steel sheet.
   4. Frames for Wood Doors: 0.053-inch- thick steel sheet.
   5. Frames for Borrowed Lights: Same as adjacent door frame.


E. Fire Rated Frames: Fire resistive, temperature rise framing system rated for 120 minutes.
   1. Products:
      a. Vetrotech VDS 120 Fire Rated Framing System.
      b. Safi First GPX Architectural Series Frame.
      c. Substitutions: Not allowed.

2.9 THERMALLY BROKEN HOLLOW METAL FRAMES

A. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames, provide where indicated thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate from minimum 16 gauge galvannealed steel meeting ASTM 236.

B. Basis of Design: Ceco Door Mercury Series, Extra Heavy Duty.
   1. Substitutions: Allowed in accordance with Section 00 26 00.
   2. Finish: Paint to match aluminum composite panel finish. Refer to specification section 074243 – Aluminum Composite Panels for more information.

2.10 HOLLOW METAL DOORS FOR SEVERE STORM SHELTERS

A. General: Provide complete tornado or hurricane resistant door and frame shelter assemblies constructed to resist the design wind pressures for components and cladding and missile impact loads as described in ICC 500 - 2014, ICC/NSSA Standard for the Design and Construction of Storm Shelters. Only single opening and paired opening doors and their frames constructed to resist calculated design wind pressures and laboratory tested missile impacts are acceptable.

   1. Door systems, both single doors and paired openings, tested and complying with ICC 500 - 2014 and FEMA P-361 (2015), Design and Construction Guidance for Community Safe Rooms and supported by third party test results.
2. Sheets fabricated on exterior openings from commercial quality hot dipped zinc coated steel complying with ASTM A924 A60. Gauges to be in accordance with manufacturers tested assemblies.

3. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).

4. Top Edge: Reinforce top of doors with a continuous steel channel extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached and welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.

5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".

6. Finish: Paint to match interior hollow metal doors and frames.

B. Manufacturers Basis of Design:
1. Curries Company (CU) - StormPro Series.

2.11 FRAMES FOR SEVERE STORM SHELTERS

A. General: Subject to the same compliance standards and requirements as standard hollow metal frames, provide complete tornado or hurricane resistant door and frame assemblies, for both single doors and paired openings, tested and labeled as complying with ICC 500 - 2014 and FEMA P-361 (2015) and supported by third party test results.

1. Fabricate exterior frames from 14 gauge hot dipped zinc coated steel that complying with ASTM designations A924 A60.

2. Manufacturers Basis of Design:
   a. CECO Door Products (C) - StormPro Series.
   b. Curries Company (CU) - StormPro Series.

3. Finish: Paint to match interior hollow metal doors and frames.

2.12 FRAME ANCHORS

A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

5. FEMA 361 Storm Shelter Anchors: Masonry T-shaped, wire masonry type, or existing opening type anchors.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.
2.13 STOPS, MOLDINGS AND VISION KITS

A. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, same material as frames.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Vision Kits:
   1. Non-rated doors: Manufacturer’s standard non-rated vision kit, minimum 0.032 inch thick, same material as door face sheet.
   2. Rated doors: Manufacturer’s standard low-profile vision kit with U.L. listing for rated assemblies.

2.14 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.

2.15 FABRICATION

A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

B. Hollow Metal Doors:
   1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration.
   2. Glazed Lites: Factory cut openings in doors.
   3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.

C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   5. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Two anchors per jamb up to 60 inches high.
         2) Three anchors per jamb from 60 to 90 inches high.
         3) Four anchors per jamb from 90 to 120 inches high.
         4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
      b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Three anchors per jamb up to 60 inches high.
         2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
c. Compression Type: Not less than two anchors in each jamb.
d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.
b. Double-Door Frames: Two door silencers.

D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 electrical Sections.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.16 STEEL FINISHES
A. Prime Finish: Clean, pretreat, and apply manufacturer’s standard primer.
1. Shop Primer: Manufacturer’s standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION
3.1 INSTALLATION
A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
a. At fire-protection-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

c. Install frames with removable glazing stops located on secure side of opening.

d. Install door silencers in frames before filling with spray-applied foam insulation.

e. Remove temporary braces necessary for installation only after frames have been properly set and secured.

f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

b. Metal-Stud and Masonry Partitions: Fully insulate all new hollow metal frames installed in metal-stud partition walls with spray-applied foam insulation product as referenced in paragraph 2.2.

3. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

4. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

5. Insulating of Hollow Metal Frames: All interior and exterior hollow metal frames shall be fully filled with spray foam insulation unless noted otherwise.

a. Spray-Foam Insulation:

1) Acceptable Products:

a) E84 Class 1 Fire Retardant Spray Foam Insulation as manufactured by Handi-Foam.

b) GacoFireStop 5500 as manufactured by Gaco Western.

c) Substitutions: Allowed in accordance with Section 00 26 00.

6. Grouting of hollow metal frames at storm shelter: All new hollow metal frames at storm shelter shall be fully grouted prior to installation.

a. Fully coat the inside of the frame a bituminous mastic.

b. Products: mortar grout cured by chemical reaction. Grout must have a maximum of 4-inch slump and be hand troweled in place. Temporary frame bracing may be required to prevent distortion of the frame while grouting.

c. Clean excess grout from the exposed faces of the hollow metal frame prior to painting/finishing.

B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:
a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 08 11 13
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid-core doors with wood-veneer faces.
   2. Factory finishing flush wood doors.
   3. Factory machining for hardware.

B. Related Sections:
   1. Division 08 Section "Glazing" for glass view panels in flush wood doors.
   2. Section 01 81 13.14 "Sustainable Design Requirements".

1.2 SUBMITTALS

A. Product Data: For each type of door indicated. 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-protection ratings for fire-rated doors.

C. Samples: For factory-finished doors.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 CLOSEOUT SUBMITTALS

A. Warranty as specified elsewhere in this Section.

1.5 QUALITY ASSURANCE

A. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

B. Fire-Rated Wood Doors: Doors 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 UBC Standard 7-2 or UL 10C.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Composite wood products shall be documented to have low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins as described in Section 01 81 13.14 “Sustainable Design Requirements”.

B. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.3 DOOR CONSTRUCTION, GENERAL

A. WDMA I.S.1-A Performance Grade:
   1. Heavy Duty unless otherwise indicated.

B. Particleboard-Core Doors:
   2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
   3. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

C. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
   1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
   2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

D. Mineral-Core Doors:
   1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
   2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.4 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:
   1. Species: To be selected from manufacturer’s full range, including premium options.
   2. Grade: Premium, with Grade A faces.
   3. Cut: To be selected from manufacturer’s full range, including premium options.
   5. Assembly of Veneer Leaves on Door Faces: Balance match.
   6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
   7. Core:
      a. Non-rated doors: Particleboard core.
      b. Rated doors: Mineral core.
   8. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.

2.5 LIGHT FRAMES

A. Non-Rated Light Frames: Provide flush wood lite mouldings on all wood doors to with glass lites.
   1. Basis of Design: Moulding VT1 as manufactured by VT Industries.
   2. Species and finish to match wood door.

B. Rated Lite Frames: Provide flush wood lite mouldings on all wood doors to with glass lites.
   1. Wood Doors: Moulding VT1 with fire clips as manufactured by VT Industries.
      a. Species and finish to match wood door.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

C. Openings: Cut and trim openings through doors in factory.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section “Glazing.”

2.7 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory that are indicated to receive transparent finish.
C. Transparent Finish:
   1. Grade: Premium.
   2. Finish: WDMA TR-6 catalyzed polyurethane.
   3. Staining: As selected by Architect from manufacturer's full range.
   4. Effect: Open-grain finish.
   5. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
   1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 3/4 inch from bottom of door to top of floor slab unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
      a. Comply with NFPA 80 for fire-rated doors.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION 08 14 16
PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes access doors and frames for walls and ceilings.

1.2 SUBMITTALS
A. Product Data: For each type of access door and frame indicated.
B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
C. Samples: For each door face material in specified finish.
D. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.3 QUALITY ASSURANCE
A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. NFPA 252 or UL 10B for vertical access doors and frames.
   2. ASTM E 119 or UL 263 for horizontal access doors and frames.

1.4 COORDINATION
A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS
A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   1. ASTM A 123/A 123M, for galvanizing steel and iron products.
   2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
   1. ASTM A 123/A 123M, for galvanizing steel and iron products.
   2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
C. Steel Sheet: electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating.
E. Steel Finishes: Comply with NAAMM’s "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Factory-Primed Finish: Manufacturer's standard shop primer.
   3. Powder-Coat Finish: Thickness not less than 1.5 mils.

F. Drywall Beads: 0.0299-inch zinc-coated steel sheet to receive joint compound.

G. Plaster Beads: 0.0299-inch zinc-coated steel sheet with flange of expanded metal lath.

H. Manufacturer's standard finish.

2.2 ALUMINUM MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6, mill finish.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6, mill finish.

C. Aluminum Sheet: ASTM B 209.
   1. Mill finish.
   2. Anodic Finish: Class I, clear anodic coating complying with AAMA 611-12.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Basis of Design: Provide access hatch from one of the following manufacturers, in all locations indicated on drawings.
      a. Sizes as indicated on drawings.
      b. Trim – to be flanged to cover edge of drywall.
   2. Acudor Products, Inc.
   3. Babcock-Davis; A Cierra Products Co.
   5. Cendrex Inc.
   7. Elmdor/Stoneman; Div. of Acorn Engineering Co.
   12. MIFAB, Inc.
   13. Milcor Inc.
   15. Williams Bros. Corporation of America (The).

   1. Locations: Wall and ceiling. Coordinate final installation locations with Architect prior to installation.
   2. Door: Minimum 0.080-inch- thick aluminum sheet.
   3. Frame: Minimum 0.060-inch- thick extruded aluminum with 1-1/4-inch- wide rolled flange.
5. Latch: Screwdriver-operated cam latch.
6. Finish: Paint to match adjacent surface.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view, provide materials with smooth, flat surfaces without blemishes.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder lock, furnish two keys per lock and key all locks alike.
   2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

F. Extruded Aluminum: After fabrication, apply manufacturer’s standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer’s written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13
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 Four-Fold metal doors with surface mounted tube frames.

B. Operation of Four-Fold metal doors includes overhead mounted electro-mechanical operators.

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 specified consisting of manufacturer’s technical Product Data and installation instructions for each type of door required, including data substantiating that products comply with requirements.

C. Submittal Drawings showing fabrication and installation of Four-Fold metal doors including plans, elevations, sections, details of components, hardware, operating mechanism, and attachments to the other units of Work. Include wiring diagrams for coordination with electrical trade.

D. Reference list including (5) successful installations of this type of door within the past two (2) years.

E. Closeout Submittal: Copy of manufacturer’s warranty including dates of warranty start and end.

1.4 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.5 QUALITY ASSURANCE

A. Doors shall be designed to withstand external or internal horizontal wind loads of 20 pounds minimum per square foot. The maximum allowable deflection shall not exceed 1/120 of the span. Fiber stresses in main members shall be limited to 27,000 pounds per square inch. Steel frames shall be designed in accordance with the AISC “Steel Construction Manual”.

B. Door manufacturer shall have at least 10 years experience in manufacturing door type specified in the United States.
1.6 DELIVERY, STORAGE AND HANDLING

A. Store delivered materials and equipment in dry locations with adequate ventilation, free from dust and water, and so as to permit access for inspection and handling.

B. Handle materials carefully to prevent damage.

1.7 CLOSEOUT SUBMITTALS

A. The door manufacturer shall provide a written standard limited warranty for material and workmanship.

B. Operation and Maintenance Data

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 MANUFACTURERS

A. Manufacturers: Four-Fold industrial metal doors manufactured by Door Engineering and Manufacturing, 400 Cherry Street, Kasota, MN 56050, (800)-959-1352 or equal products by other manufacturers approved in advance.

B. Model: FF300 Series: Glazed.

C. Substitutions: Allowed in accordance with Section 00 26 00.

2.3 MATERIALS

A. Steel Tube: ASTM A513 and ASTM A500/A500M

B. Steel Sheets: Steel sheets of commercial quality, complying with ASTM A1011/A1011M hot-rolled steel sheet.

C. Hardware: Manufacturer’s standard components.

D. Fasteners: Zinc-coated steel.

2.3 FOUR-FOLD DOORS

A. Construction: Door framing shall be minimum 11-gauge structural steel tube with 14-gauge steel sheet on the exterior and interior faces. Sheeting shall be formed on the vertical edges with no visible welds on the interior or exterior panel faces. All frames and framing members shall be true to dimension and square in all directions, and no door shall be bowed, warped, or out of line, in the vertical or horizontal plane of the door opening by more than 1/8 inch in 20 feet. Exposed welds and welds which interfere with the installation of various parts shall be ground smooth and flush.
B. Surface Mounted Tube Frame: Supply pre-hung tube frame system constructed of minimum TS6x4x0.25, designed to anchor to masonry wall construction or weld to steel structure. All hinges, track supports and operator supports shall be factory attached.

C. Factory finish: Door Panels and Tube Frames shall be finished with manufacturer’s standard PPG Spectracron epoxy primer and polyurethane top coat.
   1. Exterior Finish: Custom color to match aluminum composite panel finish.
   2. Interior finish: Custom color to match interior paint of apparatus bay.
   3. Operator and operating hardware shall be powder-coated manufacturer’s standard gray.

D. Hardware: Hardware shall include guide tracks and brackets, trolleys, center guides, not less than three pairs of jamb and fold hinges per opening, and all bolts, nuts, fasteners, etc. necessary for complete installation and operation.
   1. All hardware, including hinges and trolleys, shall be bolted to the panel for easy removal for service or panel replacement.
   2. Doors up to 16’ wide and under 30psf windload shall require no floor mounted supports, guides or tracks.
   3. Top tracks shall be adjustable on the end track hangers to allow for adjustment of the door panels in the open position and easily replaceable without removal of the door framing or operators.

E. Hinges: Jamb hinges shall be dual shear and have two thrust bearings and two needle bearings. Fold hinges shall be stainless steel and be dual shear with two thrust bearings. All bearings shall be completely concealed within the hinge barrel and include grease zerks. All hinge pins shall be minimum ¾” diameter hardened steel.

F. Hinge Guards: Provide plastic guards at jamb hinges to prevent access through hinge space.

G. Weatherstripping: Material shall be adjustable and readily replaceable and provide a substantially weather-tight installation. Weatherstripping at center shall be 1/16” cloth inserted neoprene and include no exposed fasteners on the exterior face of the panel. Weatherstripping at sill shall include two 1/16” cloth inserted neoprene sweeps with an aluminum retainer. The retainer shall be attached to the door with adhesive.

H. Perimeter Weatherstripping: Provide head, jamb and sill weatherstripping of 1/16” cloth-inserted neoprene bulb (or closed cell neoprene).

I. Vision Panels: Provide 1” insulated, tempered, vision panels of the size, shape and location as noted on the drawings. Provide project-standard insulated glass unit IG-1. Refer to specification 08 80 00 – GLAZING for basis-of-design glazing.

2.4 OPERATOR

A. Each Four-Fold door shall be operated by an overhead mounted electro-mechanical drive unit designed for high cycle operation. Operator consists of an electric motor, gear reducer, and rotating drive arm. The door shall be operated with connecting rods attached to the rotating drive arm on the operator and to control arms attached to the jamb door section and to the door lintel. The connecting rods shall be positive drive, keeping the door under firm control at all times. The connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts.

B. Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall
automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to manual operation.

C. Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity. The motor shall be wound for three phase 208 VAC, 60 Hertz operation. Motor size shall be 3/4 HP.

D. Electric Controls: Controls shall be furnished by the door manufacturer and shall be complete for each door, and built in accordance with the latest NEMA standards. Incoming electrical shall be: 208VAC 3-phase.

1. Control panel assemblies shall be UL listed as per NFPA70.
2. Controls shall include a programmable logic controller with digital message display or LED indicators. Controller shall include programmable close timers and programmable inputs/outputs.
3. Controls shall include a variable frequency drive with independent adjustment of the opening and closing speeds.
4. Enclosures shall be NEMA 4 with disconnect switch.
5. Pushbuttons (interior) for each door shall have one (1) momentary pressure three-button push-button station marked “OPEN”, “CLOSE” and “STOP”. Push button enclosure shall be NEMA 4.
6. Pull-cord operator. Provide ceiling-mounted pull cords to open east four-fold doors. Pull-cord location to be coordinated with Owner and Architect prior to installation.
7. Limit switches shall be provided to stop the travel of the door in its fully open or fully closed position.
8. Safety edges: Provide 4-wire fail-safe electric safety edges on leading edge of all doors to reverse door upon contact with obstruction.
9. Photo eyes: Provide (1) exterior, jamb mounted, light Curtain type photo eyes, NEMA 4 rated. Photo eye shall cover from floor level to 72” above floor.
10. Radio controls:
   i. Provide one (1) radio receiver for all doors.
   ii. Provide two (2) single-button remotes for each door on the west side of the apparatus bay (3 doors total). Remotes to open and close doors with single button.
11. Timer Activation Loop Detectors: Provide “pulse on exit type” loop detector to activate auto close timer once loop has been activated and cleared, include hand/auto switch to deactivate timer. G.C. to coordinate installation of preformed loop with installer prior to exterior apron being poured.
   i. Locations: Provide at east four-fold doors only. Refer to civil documents for more information, and coordinate location and loop extent with four-fold door installer.
   ii. Loop type: Direct-burial inductance loop that complies with UL 493 for direct burial cable applications as manufactured by BD Loops. Saw-cut loops not acceptable. Coordinate loop location and operation with concrete drive apron installation. Loop to be integrated into four-fold door controller panel.
12. Wiring: Door manufacturer shall supply controls and components only. Electrical contractor shall install controls and furnish and install conduits and wiring for jobsite power and control wiring.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Four-Fold metal doors in strict accordance with the approved drawings by qualified door erection crews. All door openings shall be completely prepared by the general
contractor prior to the installation of the doors. Permanent or temporary electric wiring shall be brought to the door opening before installation is started and shall be completed so as not to delay the inspection test.

B. Doors shall be set plumb, level, and square, and with all parts properly fastened and mounted. All moving parts shall be tested and adjusted and left in good operating condition.

3.2 ADJUSTING AND CLEANING

A. Inspection of the doors and a complete operating test will be made by the installer in the presence of the general contractor or architect as soon as the erection is complete. Any defects noted shall be corrected. After door approval in the above test, the general contractor must assume the responsibility for any damage or rough handling of the doors during construction until the building is turned over to the owner and final inspection is made.

B. Clean surfaces and repaint abraded or damaged finished surfaces to match factory-applied finish.

END OF SECTION 08 35 13
PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.

B. Section Includes:
1. Aluminum curtain wall system, complete with reinforcing, shims, anchors, and attachment devices.
2. Accessories necessary to complete Work.

C. Related Sections:
1. Section 01 81 13.14 Sustainable Design Requirements.
2. Section 05 55 00 Metal Fabrications.
3. Section 06 10 00 Rough Carpentry.
4. Section 07 27 26 Self-Adhering Sheet Air and Moisture Barriers.
5. Section 07 21 00 Thermal Insulation.
6. Section 07 42 13.19 Insulated Metal Wall Panels
7. Section 07 42 43 Composite Wall Panels
8. Section 07 92 00 Joint Sealants.
9. Section 08 80 00 Glazing.

1.2 REFERENCES

A. Aluminum Association (AA):
1. DAF-45 Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association (AAMA):
2. 501.2 Field Check of Metal Curtain Walls for Water Leakage.
4. 701.2 Specifications for Pile Weather-stripping.
5. Manual #10 Care and Handling of Architectural Aluminum From Shop to Site.
6. TIR-A8 Structural Performance of Composite Thermal Barrier Framing Systems.

C. American National Standards Institute (ANSI):

D. American Society for Testing and Materials (ASTM):
1. A36 Structural Steel.
3. A525 General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
4. A526 Sheet Steel, Zinc Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
5. B209 Aluminum and Aluminum-Alloy Sheet and Plate.
10. E283 Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
14. E774 Sealed Insulating Glass Units.

E. Consumer Product Safety Commission (CPSC):

F. Glass Association of North America (GANA):

G. Steel Structures Painting Council (SSPC):
1. SP2 Hand Tool Cleaning.
2. SP3 Power Tool Cleaning.
3. Paint 12 Cold-Applied Asphalt Mastic (Extra Thick Film).

1.3 SYSTEM REQUIREMENTS

A. General Standard: In addition to requirements shown or specified, comply with applicable provisions of Aluminum Curtain Wall Design Guide Manual for design, materials, fabrication and installation of component parts.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer licensed in the state of Iowa, using performance requirements and design criteria indicated.

C. Design Requirements:
1. Metal stick-framed systems with interior and exterior exposed metal framing.
2. Perimeter conditions: Allow for installation tolerances, expansion and contraction of adjacent materials, and sealant manufacturer’s recommended joint design.
3. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage or moisture disposal.
4. Requirements shown by details are intended to establish basic dimension of unit, sight lines and profiles of members.
5. Do not assume glass, sealants, and interior finishes contribute to framing member strength, stiffness, or lateral stability.
6. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
7. Allow for expansion and contraction due to structural movement without detriment to appearance or performance.
8. System to drain to exterior face of wall, water entering joints and condensation occurring within system by drain holes and gutters of adequate size to evacuate water without infiltration to interior or top of lower lites of glass.
10. Metal faces required to be visually flat under all lighting conditions, subject to acceptance
11. Provide dense EPDM isolators at pressure-plated members to maintain adequate compression on glazing material.
12. Provide uniform color and profile appearance at components exposed to view.
13. Provide interior dense EPDM gasket with sealed corners, with maximum 30% compression when glazed, to create water and air seal. Provide exterior dense EPDM wedge gasket at the verticals and exterior EPDM gasket at the horizontals with a maximum 30% compression when glazed, to create a water and air seal.
15. Provide pre-punched pressure plates to ensure correct quantity and spacing of fasteners.
16. Keep stresses placed on structural silicone sealants within sealant manufacturer's recommended maximum.
17. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

D. Performance Requirements:
1. Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall (by Curtain Wall Manufacturer).
2. Glazing is physically and thermally isolated from framing members.
3. System is pressure equalized at its interior face.
   a. Air infiltration: Not to exceed 0.06 cfm per square foot of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf (300 Pa).
   b. Water Resistance (static): No uncontrolled leakage when tested in accordance with ASTM E331 at test pressure of 15.0 psf (720 Pa) as defined in AAMA 501.
   c. Uniform Load: Apply static air design load of 40 psf in positive and negative direction in accordance with ASTM E 330. At structural test load equal to 1.5 times specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans to occur.

E. Structural Requirements:
1. Wind Loads: Provide glazed aluminum curtain wall system, 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.
   a. Deflection of framing members in a direction normal to wall plane shall comply with AAMA TIR 11:
      1) For spans <13'-6" + L/175 max and spans > 13'-6" less than 40'-0" = L/240 + ¼"
   b. Deflection of framing members in a direction normal to wall plane per Allowable deflection typically reads per AAMA TIR 11:
      1) For spans <13'-6" + L/175 max and spans > 13'-6" less than 40'-0" = L/240 + ¼"
      2) Live load deflection shall not exceed 3/8".
   c. Deflection of framing members overhanging an anchor point is limited to 2 times the length of the cantilevered member, divided by 175.
   d. Delete below if structural testing is not required. See Evaluations.
   e. Test Performance: Provide glazed aluminum curtain wall system that does not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.
1) Test Pressure: 150 percent of inward and outward wind-load design pressures.
2) Duration: As required by design wind velocity; fastest 1 mile of wind for relevant exposure category.

F. Dead Loads: Provide glazed aluminum curtain wall system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load. Provide a minimum 1/8-inch clearance between members and top of fixed panels, glazing, or other fixed part immediately below. Provide a minimum 1/16-inch clearance between members and operable windows and doors.

G. Live Loads: Provide glazed aluminum curtain wall system, including anchorage, that accommodates supporting structure's deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.

H. Thermal Requirements: Framing systems: Accommodate expansion and contraction movement due to surface temperature differential of 180F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance or other detrimental effects.

I. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, thermal transmittance (U-Factor): Not more than .31 Btu/h-ft²-F.

J. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor: Not less than 66 for frame.

K. Sound Transmission: When tested to ASTM E90, the Sound Transmission Class (STC): Not less than 33.

L. Laboratory Testing: Refer to Section 01 40 00 for requirements.

M. Interface:
1. Furnish inserts and anchoring devices, which need to be preset and built into structure to appropriate trade.
2. Supply on timely basis to avoid delay in Work.
3. Instruct other trades of proper location and position.
4. Furnish setting drawings, diagrams, templates and installation instructions.

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Specifications.

B. Product Data:
1. Submit manufacturer's descriptive literature for each manufactured product.
2. Include information for factory finishes, accessories and other required components.
   a. Include color charts for finish indicating manufacturer's standard colors available for selection.

C. Shop Drawings:
1. Submit drawings indicating elevations, detailed design, dimensions, member profiles, joint locations, arrangement of units, member connections, and thickness of various components.
2. Show following items:
   a. Details of special shapes.
   b. Reinforcing.
   c. Drainage details and flow diagrams.
   d. Anchorage system.
   e. Interfacing with building construction.
   f. Provisions for system expansion and contraction
   g. Thermal breaks.

4. Indicate glazing details, methods, locations of various types and thickness of glass, emergency breakout locations, and internal sealant requirements.

5. Clearly indicate locations of exposed fasteners and joints for Architect's acceptance.

6. Clearly show where and how manufacturer's system deviates from Contract Drawings and these Specifications.

D. Samples:
   1. Submit manufactures samples indicating quality of finish in required colors.
   2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
   3. Submit samples of sealants for color selection.

E. Test Reports: Submit certified copies of previous tests reports by independent laboratory substantiating performance of system. Include other supportive data as necessary.

1.5 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.6 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Warranties as specified elsewhere in this Section.

1.7 QUALITY ASSURANCE

A. Single Source Responsibility:
   1. Provide curtain wall system products of single manufacturer.

B. Engineer Qualifications: Professional Structural Engineer registered in State where Project is located.

C. Installer Qualifications: Certified in writing by system manufacturer as qualified for specified systems.

D. Functional Performance Testing:
   1. Owner's testing agency will perform field functional performance testing. Refer to specification section 01 91 17 - Building Enclosure Functional Performance Testing for more information.
1.8 PRE-INSTALLATION CONFERENCE

A. Conduct pre-installation conference in accordance with Section 01 31 00.

B. Conference Purpose and Agenda:
   1. Arrange with Architect and representatives of window and sealant manufacturer to visit Project site factory before beginning glazing operations to analyze site conditions and inspect surfaces and joints to be sealed in order that recommendations may be made should adverse conditions exist.
   2. Discuss following items:
      a. Weather conditions under which work will be done.
      b. Anticipated frequency and extent of joint movement.
      c. Joint design.
      d. Glazing procedures.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 60 00.

B. Protect finished surfaces to prevent damage.

C. Do not use adhesive papers or sprayed coatings, which become firmly bonded when exposed to sun.

D. Do not leave coating residue on surfaces.

E. Deliver glass units with manufacturer's labels intact on interior side of glass. Ensure labels indicate glass thickness, unit location, glass strength and orientation of units in vertical position.

F. Protect glass edges and corners to prevent chipping, cracking, and other similar damages.

1.10 PROJECT CONDITIONS

A. Ensure ambient and surface temperatures and joint conditions are suitable for installation of materials.

1.11 WARRANTY

A. Provide written warranty in form acceptable to Owner jointly signed by manufacturer, installer and Contractor warranting work to be watertight, free from deflective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 1 year from date of Substantial Completion.

B. Warranty to cover following:
   1. Complete watertight and airtight system installation within specified tolerances.
   2. Glass and glazing gaskets will not break or "pop" from frames due to design wind, expansion or contraction movement or structural loading.
   3. Glazing sealants and gaskets will remain free from abnormal deterioration or dislocation due to sunlight, weather or oxidation.

C. Provide written warranty stating organic coating finish will be free from fading more than 10%, chalking, yellowing, peeling, cracking, pitting, corroding or non-uniformity of color, or gloss
deterioration beyond manufacturer's descriptive standards for 5 years from date of Substantial Completion and agreeing to promptly correct defects.

PART 2 - PRODUCTS

1. AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.1 MANUFACTURERS AND PRODUCTS

A. Subject to compliance with requirements indicated, provide products by one of the following:
   1. Oldcastle Building Envelope® Terrell, TX.
   2. Substitutions: Allowed in accordance with Section 00 26 00.

B. Curtain wall systems included in this section are as follows:
   1. Oldcastle Building Envelope: RELIANCE – TC Type II: 2-1/2” x 7-1/4” mullion profiles, pressure-glazed and structural silicone glazed, front set, exterior glazed, stick wall system with aluminum pressure plates.

2.2 FRAMING MATERIALS AND ACCESSORIES

A. Aluminum:
   1. ASTM B221, alloy 6063-T6 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.

B. Internal Reinforcing:
   1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
   2. Shapes and sizes to suit installation.
   3. Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.

C. Inserts and Anchorage Devices:
   1. Manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars or tubes.
   2. Hot-dip galvanize steel assemblies after fabrication to comply with ASTM A123, 2.0 ounce minimum coating.

D. Fasteners:
   1. Non-magnetic stainless steel or other non-corrosive plating, compatible with materials being fastened for non-exposed locations.
   2. Series 300 stainless steel for exposed locations.
   3. Provide nuts or washers of design having means to prevent disengagement; deforming of fastener threads not acceptable.
   4. Provide concealed fasteners wherever possible.
   5. For exposed locations, provide countersunk flathead fasteners with finish matching item fastened.

E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

F. Shims: Non-staining, non-ferrous, type as recommended by system manufacturer.
G. Protective Coatings: If applicable, provide cold applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

H. Glazing Gaskets:
1. Compression type design, exterior replaceable, extruded EPDM. Interior is a dense EPDM [closed cell EPDM sponge] gasket.
2. Comply with ASTM C509 or C864.
3. Profile and hardness as necessary to maintain uniform pressure for watertight seal.
4. Manufacturer's standard black color.

I. Internal Sealants: Types recommended by system manufacturer to remain permanently elastic, tacky, non-drying, non-migrating and weather-tight.

J. Curtain Wall Insulation: Refer to Section 07 21 00.

K. Caps:
1. Window wall perimeter and intermediate horizontal mullions: Standard captured cap.
2. Typical vertical mullion: SSG (structural silicone glazed), unless noted/shown otherwise.

2.3 GLAZING AND SPANDREL PANELS

A. See Section 08 80 00.

2.4 SYSTEM FABRICATION

A. Take accurate field measurements to verify required dimensions prior to fabrication.

B. Location of exposed joints is subject to Architect's acceptance.

C. Provide dense EPDM continuous isolator at pressure plated members to separate exterior pressure plates and interior framing members.

D. Fabricate components in accord with approved shop drawings. Remove burrs and ease edges. Shop fabricate to greatest extent practicable to minimize field cutting, splicing, and assembly. Disassemble only to extent necessary for shipping and handling limitations.

E. Steel Components:
1. Clean surfaces after fabrication and immediately prior to application of primer in accord with SSPC-SP2 or SSPC-SP3 at manufacturer's option.
2. Apply specified shop coat primer in accord with manufacturer's instructions to provide 2.0 minimum dry film thickness.

F. Fabricate components true to detail and free from defects impairing appearance, strength or durability. Fabricate custom extrusions indicated and as necessary for complete installation.

G. Fabricate components to allow for accurate and rigid fit of joints and corners. Match components carefully ensuring continuity of line and design. Ensure joints and connections are flush and weather-tight. Ensure slip joints make full, tight contact and are weather-tight.

H. Reinforce components as required at anchorage and support points, at joints, and at attachment points for interfacing work.
I. Provide structural reinforcing within framing members where required to maintain rigidity and accommodate design loads.

J. System design and sealants to accommodate internal weep and drainage system not visible to exterior.

K. Allow for adequate clearance around perimeter of system to enable proper installation and for thermal movement within system.

L. Separate dissimilar metals with protective coating or preformed separators to prevent contact and corrosion.

M. Provide framing members to rigidly glaze spandrel panels within framing system.

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
   1. Product: OBE MS-375TC Medium Stile Door.

2.6 ALUMINUM FINISHES

A. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and 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.
   1. Color and Finish: Custom color to match Aluminum Composite Panel finish, as approved by the architect. Refer to specification section 074243 – Aluminum Composite Panels for more information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01400.

B. Verify dimensions, tolerances, and method of attachment with other Work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and applicable provisions of AAMA Aluminum Curtain Wall Design Guide Manual.

B. Align assemblies plumb and level, free of warp or twist, aligning with adjacent Work.

C. Tolerances:
   1. Limit variations from plumb and level:
      a. 1/8 inch in 20'-0" vertically and horizontally.
      b. 1/4 inch in 40'-0" either direction.

   2. Limit offsets in theoretical end-to-end and edge-to-edge alignment:
      a. 1/16 inch where surfaces are flush or less than 1/2 inch out of flush and separated by not more than 2 inches.
b. 1/8 inch for surfaces separated by more than 2 inches.
3. Step in face: 1/16 inch maximum.
5. Location: 1/4 inch maximum deviation of any member at any location.
6. Tolerances are not accumulative.

D. Provide attachments and shims to permanently fasten system to building structure.

E. Anchor securely in place, allowing for required movement, including expansion and contraction.

F. Separate dissimilar materials at contract points, including metal in contact with masonry or concrete surfaces, with protective coating or preformed separators to prevent contact and electrolytic action.

G. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weather-tight construction.

H. Water Drainage: Compartmentalize each light of glass using joint plugs and silicone sealant to divert water to horizontal weep locations. Locate weep holes in horizontal pressure plates and covers to divert water to exterior of building.

J. Glazing:
   1. Install glazing gaskets and sealants in accordance with manufacturer's instructions without exception, including surface preparations. Refer to Section 08 80 00 for additional requirements.
   2. Outside glazed and held in place with extruded aluminum pressure plates anchored to mullion using Drill-Flex fasteners spaced no greater than 9” on center.

K. Curtain Wall Insulation:
   1. Install curtain wall insulation specified in Section 07 21 00.

3.3 CLEANING

A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, and other foreign materials.

B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION 08 44 13
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes aluminum-framed assemblies glazed with translucent polycarbonate panels as follows:
   1. Wall assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum components of panel assemblies. Include qualification data for installer, product test reports, and evaluation reports from ICC-ES.

B. Shop Drawings: For panel assemblies.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.

C. Samples: In manufacturer's standard size.
   1. For each type of structured-polycarbonate panel.
   2. For each type of exposed finish for framing members.

D. Fabrication Samples: Of each framing system intersection and adjacent panels, made from 12-inch lengths of full-size framing members and showing details of the following:
   1. Joinery.
   2. Anchorage.
   4. Translucent polycarbonate panels.
   5. Flashing and drainage.

E. Submittal: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Certified test reports made by independent organization verifying material will meet all performance requirements of this specification. Previously completed test reports acceptable if indicative of products used on this project. Test reports required are:
1. Self-Ignition Temperature (ASTM 1929)
2. Smoke Density (ASTM D-2843)
3. Burning Extent (ASTM D-635)
4. Interior Flame Spread (ASTM E-84)
5. Color Difference (ASTM D-2244)
6. Tests on a weathered system after approximately 10 years of actual exposure in South Florida field conditions. Tests shall include:
   a. Uniform static air pressure per ASTM 330
   b. Impact loading per ASTM E695
   c. Cyclic static air pressure and missile impact level D per ASTM 1886 & ASTM E1996.
7. Weathering Evaluation before and after exposure to 300°F, 25 minutes include Light Transmission and Color Change, per ASTM E-1175, and ASTM D-2244 respectively.
8. Large Missile Test - Impact Resistance per SFBC PA 201-94
9. Insulation's ‘U’ value for Center of Glazing per NFRC100.
10. Insulation’s ‘U’ value for skylight system, glazing and aluminum framing, per NFRC 100 & NFRC 700 certification.
11. Visible light Transmission (VT) per ASTM E972 & ASTM E1084
12. Solar Heat Gain Coefficient (SHGC) based on tests or calculations which are based on tests per methodology and procedure given in the NFRC/Calorimeter Standard.
13. Maximum air infiltration rate for fenestration assemblies of Curtain walls, per NFRC 400 or ASTM E283.
14. Water Penetration (ASTM E-331)
15. Load Bearing Capability (ASTM E-330)
16. Performance of exterior windows, curtain walls when impacted by wind-borne debris per ASTM E 1996, Level D
17. Haze per ASTM D 1003 for glare measurement.
18. ICC evaluation service report for compliance with IBC building code for polycarbonate glazing as an approved light transmission plastic with CC1 rating per chapter 26, and class A interior finish glazing per chapter 8.
19. Sound Transmission Loss (STC) per ASTM E413

1.4 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For panel assemblies to include in maintenance manuals.
B. Warranty(s) as specified elsewhere in this Section.

1.6 QUALITY ASSURANCE

A. Glazing panels: Evaluated and listed by recognized building code evaluation organization: International Council Evaluation Service Inc (ICC-ES)
B. Materials and Products: Manufactured by company continuously and regularly employed in manufacture, engineering, design, stocking and building of skylights using specified material and system for period of at least ten (10) years. Manufacturers: Provide list of at least ten (10) projects having been in place minimum of ten (10) years, with similar size, scope, climate and type.
C. Erection: By factory-approved installer in business of erecting similar material at least five (5) consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

D. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system, in accordance with the requirements of this specification.

E. Mockups: Build mockups to verify selections made under Sample submittals and demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical panel assemblies as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Architect specifically approves 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.

F. Functional Performance Testing:
   1. Owner's testing agency will perform field functional performance testing. Refer to specification section 01 91 17 - Building Enclosure Functional Performance Testing for more information.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies that fail in materials or fabrication workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Deterioration of metals, and other materials beyond normal weathering.
      c. Water leakage.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace translucent polycarbonate panels that exhibit defects in materials or workmanship within specified warranty period.
   1. Defects include, but are not limited to, the following:
      a. Delamination.
      b. Color changes exceeding requirements.
      c. Losses in light transmission beyond 6 percent from original when measured after 10 years according to ASTM D 1003.
   2. Warranty Period: 10 years from date of Substantial Completion.
   3. Warranty Period for Hail Damage: Five years from date of Substantial Completion for hail stone penetration exceeding requirements.

C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
   2. Warranty Period: 10 years from date of Substantial Completion.

D. Installer's Warranty: Installer agrees to repair or replace components of panel assemblies that fail in installation workmanship within specified warranty period.
   1. Failures include, but are not limited to, installation defects and water leakage.
   2. Warranty Period: Two years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design translucent polycarbonate-panel assemblies.

B. Structural Loads: Per ASCE 7-10 loads

C. Deflection Limits:
   1. Vertical Panel Assemblies: Limited to 1/120 of clear span for each assembly component of aluminum framing and panel joint according to the IBC, Table 1604.3 for exterior walls with flexible materials.

D. Structural-Test Performance: Panel assemblies tested according to ASTM E 330, as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified deflection limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Windborne-Debris-Impact-Resistance Performance: Panel assemblies that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and the testing information in ASTM E 1996 for Wind
   1. Large-Missile Test: For glazed openings located within 30 feet of grade.
   2. Small-Missile Test: For glazed openings located more than 30 feet above grade.

F. Hail-Stone Impact Resistance: Panel assemblies that resist penetration by hail stone smaller than 1-3/16 inches in diameter, impacting panel surface at a final velocity up to 44 fps per ASTM E 822.

G. Panel Clip Performance: Corrosion-resistant clips tested to meet a minimum 90-lb/sq. ft. wind uplift when tested according to ASTM E 330.

H. Panel End Seals: Continuous factory-applied, self-adhered micro-filter tape over open panel cells.

I. Panel Performance:
   1. Smoke-Developed Index: 450 or less according to ASTM E 84, or 75 or less according to ASTM D 2843.
   2. Flame Spread: 25 or less when tested according to ASTM E 84.
   3. Combustibility Classification: Class CC1 based on testing according to ASTM D 635.
   4. Interior Finish Classification: Class A based on testing according to ASTM E 84.
   5. Visible Light Transmittance (VT) Loss: 6 percent maximum over 10 years, measured according to ASTM D 1003.
   6. Thermal Aging: When exposed to 300 deg F for 25 minutes, interior and exterior panels tested according to ASTM D 2244.
      a. Color Retention: 0.75 (Hunter) units ΔE maximum fade.
b. Color Darkening: 0.3 (Hunter) units ΔL maximum.

c. Cracking or Crazing: None when exposed to 300 deg F for 25 minutes.

d. Delamination: None when exposed to 300 deg F and 0 deg F for 25 minutes.

7. Impact Resistance: No failure at impact of 500 lbf when tested according to ASTM E 695.

8. Concentrated Loading: No damage while applying a load of 600 lbf over 1 sq. ft. when tested according to 29 CFR 1910.23(e)(8); and no damage while applying a load of 400 lbf over 3 inches in diameter according to ASTM E 661.

J. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

K. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

c. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

L. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC.

M. Thermal Transmittance (U-Factor): Fixed panel and mill finish aluminum framing whole assemblies U-factor of not more than 0.28 Btu/sq. ft. x h x deg F vertical application and 0.31 Btu/sq. ft. x h x deg F sloped application as determined according to NFRC 100.

c. Solar-Heat-Gain Coefficient (SHGC): Panel assembly SHGC of no greater than 0.37 as determined according to NFRC 200.

d. Visible Light Transmittance (VT): 0.30 or greater according to NFRC 202; or 0.39 or greater according to ASTM E 972, ASTM E 1084.

e. Air Infiltration: Maximum air leakage through fixed glazing and framing assemblies of 0.06 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at minimum static-air-pressure differential of 1.57 lbf/sq. ft.

2.3 TRANSLUCENT POLYCARBONATE-PANEL ASSEMBLIES

A. Translucent Polycarbonate-Panel Assemblies: Translucent assemblies supported by aluminum framing and glazed with translucent polycarbonate panels.

c. Basis-of-Design Product: CPI Daylighting, Inc. UniQuad

d. Substitutions: Allowed in accordance with Section 00 26 00.

2.4 TRANSLUCENT POLYCARBONATE WALL PANELS

A. Translucent, Multiwall Cellular Polycarbonate Panel Thermally Broken Assembly: Two independent, multiwall cellular cross-sections, polycarbonate glazing panels with air-insulated spaces and coextruded UV protection, integrated into panel assembly with concealed metal connectors consisting of two-piece male/female battens with built-in silicone gaskets. Incorporate unitized panel assembly into complete aluminum frame system without exposed mullions. Design panels for exterior panel replacement, independent of interior single panel and without exposing the interior, or compromising weather-tightness, or interfering with normal working functions of building.

B. Panel Thickness: Overall assembly minimum 5 3/8-inch
C. Perimeter Frame Thermal Break: 0.25-inch minimum, poured and debridged separation consisting of two-part chemically curing, high-density polyurethane, mechanically and adhesively joined to aluminum framing.

D. UV Resistance: Coextruded on weather-exposed surfaces during glazing panel manufacture.

E. Color: Clear matte (exterior) over ice white matte (interior)

F. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by independent testing agency.
   1. Sound Transmission Class (STC): Paired-panel assemblies minimum overall acoustic value of following STC:
      a. Paired-Panel Assembly; 4 Inches Thick: STC 26

G. Human-Impact Resistance: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 695 and withstand impact loading by blunt object of 2000 ft.-lb.

H. Panel Performance:
   1. Color Retention: 3.0 (Hunter) units ΔE, maximum fade as measured according to ASTM D 2244 when tested on minimum two white color samples after panels have weathered outdoors in Arizona with panels exposed to minimum 36.78 Langley.
   2. Haze Factor: Greater than 90 percent when tested according to ASTM D 1003.

I. Transom replacement panel glazing: Dual color 22 mm cellular polycarbonate glazing, clear matte over ice white matte with new gaskets to fit.

2.5 ALUMINUM FRAMING SYSTEMS

A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.

B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.

D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.
   1. At closures, retaining caps, or battens, use ASTM A 193, 300 series stainless-steel screws.
   2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

F. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

G. Exposed Flashing and Closures: Aluminum sheet not less than 0.040-inch thick, finished to match framing.

H. Framing Gaskets: Manufacturer's standard gasket system with low-friction surface treatment designed specifically for retaining translucent polycarbonate panels.

I. Frame-System Sealants: As recommended in writing by manufacturer.

J. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

A. Fabricate aluminum components that, when assembled, have following characteristics:
   1. Sharp, straight profiles free of defects or deformations.
   2. Accurately fitted joints with ends cope or mitered.
   3. Internal guttering systems or other means to drain water passing through joints and moisture migrating within assembly to exterior.

B. Fabricate aluminum sill closures with weep holes and for installation as continuous component.

C. Reinforce aluminum components as required to receive fastener threads.

2.7 ALUMINUM FINISHES

A. High-Performance Organic Finish: Custom Three-coat AAMA 2605, Metallic fluoropolymer containing not less than 70 percent PVDF resin by weight in color coat finish. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Color and Finish: Custom color to match Aluminum Composite Panel finish, as approved by the architect. Refer to specification section 074243 – Aluminum Composite Panels for more information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions.
1. Do not install damaged components.
2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
3. Rigidly secure nonmovement joints.
4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
5. Seal joints watertight unless otherwise indicated.

B. Metal Protection: Where aluminum components contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer.

C. Install components plumb and true in alignment with established lines and elevations.

D. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
   1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in-line, edge-to-edge, at corners, or where reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
   2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

3.3 FIELD QUALITY CONTROL

A. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Prepare test and inspection reports.

END OF SECTION 08 45 13
SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Swinging doors.
   2. Sliding doors.
   3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical door hardware.
   3. Cylinders specified for doors in other sections.

C. Related Sections:
   1. Division 01 Section "Sustainable Design Requirements" for additional LEED documentation and requirements.
   2. Division 08 Section "Hollow Metal Doors and Frames".
   3. Division 08 Section "Flush Wood Doors".
   4. Division 08 Section "Aluminum-Framed Entrances and Storefronts".

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   5. NFPA 70 - National Electrical Code.
   8. NFPA 105 - Installation of Smoke Door Assemblies.

E. Standards: All hardware specified herein shall comply with the following industry standards:
   1. ANSI/BHMA Certified Product Standards - A156 Series
   2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule.
Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:
   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
   a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.
   c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Proof of Qualification: Provide copy of manufacturer(s) Factory Trained Installer documentation indicating proof of status as a qualified installer of Windstorm assemblies.

E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

F. Informational Submittals:

1. LEED Requirements:
   a. Product Data for Credit MRC2: For products having a product-specific Type III Environmental Product Declaration (EPD), provide documentation of the EPD. Include statement indicating costs for each product having an EPD.
b. Product Data for Credit MRc4: For products having a Health Product Declaration (HPD), provide documentation of the HPD. Include statement indicating costs for each product having an HPD.

2. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

B. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

C. Warranties as specified elsewhere in this Section.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Windstorm Assembly Installer Qualifications: Installers are to be factory trained for shop and field installation prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project. A pre-installation site inspection of the frame and floor conditions shall be conducted by the factory trained installer prior to any Windstorm assembly hardware applied to the opening.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
   1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
   2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
F. Severe Storm Shelter Openings: Provide complete door systems for hurricane or tornado resistant storm shelters and other areas of refuge complying and tested according to FEMA P-361 (2015), Design and Construction Guidance for Community Safe Rooms; and ICC 500 (2014), ICC/NSSA Standard for the Design and Construction of Storm Shelters.

G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
   1. Function of building, purpose of each area and degree of security required.
   2. Plans for existing and future key system expansion.
   3. Requirements for key control storage and software.
   4. Installation of permanent keys, cylinder cores and software.
   5. Address and requirements for delivery of keys.

I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
   1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
   2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
   3. Review sequence of operation narratives for each unique access controlled opening.
   4. Review and finalize construction schedule and verify availability of materials.
   5. Review the required inspecting, testing, commissioning, and demonstration procedures.

J. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop...
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Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of the hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:
   1. Ten years for mortise locks and latches.
   2. Five years for exit hardware.
   3. Twenty five years for manual surface door closer bodies.
   4. Two years for electromechanical door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturer’s Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers’ names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in
writing and in accordance with the procedures and time frames outlined in Section 00 26 00. Substitutions after bid award are not allowed. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than the following:
   1. Floor Closers: 63%
   2. Pivots: 78%
   3. Cylindrical Locks: 58%
   4. Mortise Locks: 57%
   5. Exit Devices: 54%
   6. Door Closers: 51%
   7. Overhead Stops: 46%

2.3 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
   1. Quantity: Provide the following hinge quantity:
      a. Two Hinges: For doors with heights up to 60 inches.
      b. Three Hinges: For doors with heights 61 to 90 inches.
      c. Four Hinges: For doors with heights 91 to 120 inches.
      d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

   2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
      a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
      b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

   3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
      a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
      b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

   4. Hinge Options: Comply with the following:
      a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

   5. Manufacturers:
      a. Ives (IV).
      b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
      c. Stanley Hardware (ST) - CB Series.

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
   1. Manufacturers:
C. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 Grade 1-600 certified pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed teflon coated stainless pin, and twin self lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

D. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should comply with ANSI/BHMA A156.14.

1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.
2. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.
3. Manufacturers:
   a. Hafele Manufacturing (HF).
   b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.4 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:
   a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
   b. Securitron (SU) - EL-CEPT Series.
   c. Von Duprin (VD) - EPT-10 CON Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
   b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.
   c. Von Duprin (VD) – Equivalent to above listed McKinney tools.

2. Manufacturers:
   b. Von Duprin (VD) – CON Series.
2.5 DOOR OPERATING TRIM

A. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
5. Manufacturers:
   a. Ives (IV).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

2.6 CYLINDERS AND KEYING

A. General: Cylinder manufacturer – US Lock RXO keyway, owners existing system.
1. Acceptable Manufacturers:
   a. US Lock cylinders and cores RXO keyway.
   b. No Substitution.

B. Cylinders: Original US Lock manufacturer cylinders complying with the following:
1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. US Lock cores and cylinders to be provided by this specification section. These are not owner supplied or installed.

C. Keying System: Each type of lock and cylinders to be factory keyed.
1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. A representative from Security Locksmiths to be part of the keying meeting.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Keying of cylinders and cores by Security Locksmiths. Permanent, keyed cylinders and cores to be installed by the hardware supplier.
4. It is the intent of this specification section, 08 7100, for the cost of the cylinders, stamping of keys and keying to be part of the hardware package. No additional costs will be accepted by the owner. For a quote, the door hardware supplier of 087100 to contact:

   Security Locksmiths
   4410 SE 14th Street
   Des Moines, Iowa 50320
   Ph: (515) 287-4936
   Attn: Sharon.
D. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:
   a. Lund Equipment (LU).
   b. MMF Industries (MM).
   c. Telkee (TK).

2.7 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Extended cycle test: Locks to have been cycle tested in accordance with ANSI/BHMA 156.13 requirements to 10 million cycles.

2. Manufacturers:
   b. Sargent Manufacturing (SA) – 8200 Series.
   c. Schlage (SC) – L9000 Series.

B. Multi-Point Locksets, FEMA: Three-point locking system device engineered for in-swinging and out-swinging door applications on windstorm safe shelter rooms. Extra heavy duty steel component construction securing the door to the frame at top, bottom and center latch positions. All three latching points are automatically activated when the device is locked. Multi-Point Deadlocking System shall be used only with doors, frames and associated hardware that have been engineered, tested and approved for a complete opening assembly system.

1. Severe Storm Shelter Components: Multi-point locking system devices engineered for in-swinging and out-swinging door applications on tornado or hurricane resistant safe shelter rooms. The multi-point latching integrated device is approved for usage as part of a complete ICC 500 (2014) and FEMA P-361 (2015) door, frame and hardware assembly.

2. ANSI-BHMA listed to A156.37 Grade 1 for multi-point locks:
   a. Lever torque to retract all bolts less than 28 in.lb.
   b. Cycle tested to 800,000 cycles.

3. NFPA 80 and NFPA 101 life safety requirements.
4. UL10B or UL10C, 3-hour fire rated openings.
5. Latchbolt Construction:
   a. Center Bolt to be one piece, ¾” throw anti-friction stainless steel latch and one piece, 1” throw, hardened stainless steel deadbolt; 2-3/4” standard backset.
   b. Top and Bottom Bolts to be ¾” x ¾” stainless steel square latchbolt with ¾” projection.

6. Independent top and bottom bolt projection shall be field adjustable:
   a. From the center mortise pocket.
   b. Ability to make field adjustments while the door is in the hung position without the removal of the door.
   c. Top and Bottom Bolts and the Center Mortise Case shall be factory installed into the door assembly.

7. Bottom strike shall be offset and reversible to accommodate alignment issues due to rough opening tolerances.
8. Devices must be able to accommodate sectional rose and lever trim to match the design style and architectural finishes of the balance of the lockset and latches as specified.
9. Devices must be available with electronic access control options for higher or everyday use and traceability.
10. Devices must be available with rod-dogging indicator options:
   a. Operated by single-point latching for non-emergency or normal use of the space.
   b. Ability to hold rods in a retracted state.
   c. Day-to-day operations with mortise lock only.
   d. Indicator to show status.

11. Manufacturers:
   a. Corbin Russwin Hardware (RU) - FE6600 Series.
   b. Sargent Manufacturing (SA) - FM7300 Series.

2.8 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
   2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
   3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
   4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:
   2. Strikes for Bored Locks and Latches: BHMA A156.2.
   3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
   4. Dustproof Strikes: BHMA A156.16.

2.9 ELECTRIC STRIKES

A. Standard Electric Strikes: Heavy duty, cylindrical and mortise lock electric strikes conforming to ANSI/BHMA A156.31, Grade 1, UL listed for both Burglary Resistance and for use on fire rated door assemblies. Stainless steel construction with dual interlocking plunger design tested to exceed 3000 lbs. of static strength and 350 ft-lbs. of dynamic strength. Strikes tested for a minimum 1 million operating cycles. Provide strikes with 12 or 24 VDC capability and supplied standard as fail-secure unless otherwise specified. Provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike where specified.
   1. Manufacturers:
      a. Folger Adam EDC (FO).
      b. HES (HS).
      c. Von Duprin (VD).

B. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability.
supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.

1. Manufacturers:
   a. HES (HS) - 9400 Series
   b. HES (HS) - 9500/9600 Series.

C. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.10 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.


10. Extended cycle test: Devices to have been cycle tested in ordinance with ANSI/BHMA 156.3 requirements to 9 million cycles.

11. Rail Sizing: Provide exit device rails factory sized for proper door width application.

12. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:
   a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
b. Sargent Manufacturing (SA) - 80 Series.

c. Von Duprin (VD) - 35A/98 XP Series.

2.11 **DOOR CLOSERS**

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Manufacturers:

   a. Corbin Russwin Hardware (RU) - DC8000 Series.

   b. LCN Closers (LC) - 4040XP Series.

   c. Norton Door Controls (NO) – 9500 Series.

   d. Sargent Manufacturing (SA) - 281 Series.

2.12 **SURFACE MOUNTED CLOSER HOLDERS**

A. Electromagnetic Door Holders: Certified ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Manufacturers:

   a. Rixson (RF) - 980/990 Series.

   b. Sargent Manufacturing (SA) - 1560 Series.

2.13 **ARCHITECTURAL TRIM**

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2” less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and
not more than 1” less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer’s designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:
   a. Ives (IV).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

### 2.14 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
   1. Manufacturers:
      a. Ives (IV).
      b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
      c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
   1. Manufacturers:
      a. Glynn Johnson (GJ).
      b. Rixson Door Controls (RF).
      c. Sargent Manufacturing (SA).

### 2.15 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
   1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
   1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:
   1. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
   2. Reese Enterprises, Inc. (RE).

2.16 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1” diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
   1. Manufacturers:
      a. Security Door Controls (SD) - DPS Series.
      b. Securitron (SU) - DPS Series.

B. Switching Power Supplies: Provide switching power supplies that are dual voltage, UL listed, supervised units. Units shall be field selectable with a dedicated battery charging circuit that provide 4 Amp at 12VDC or 24VDC continuous, with up to 16 independently controlled power limited outputs. Units shall tolerate brownout or overvoltage input ± 15% of nominal voltage and have thermal shutdown protection with auto restart. Circuit breaker shall protect against overcurrent and reverse battery faults and units shall be available with a single relay fire trigger or individually triggered relayed outputs. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
   1. Manufacturers:
      a. Securitron (SU) - AQ Series.

2.17 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.


3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
   3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
   4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. MR - Markar
October 15, 2019

4. RO - Rockwood  
5. SA - SARGENT  
6. AT - Accurate Lock and Hardware  
7. OT - OTHER  
8. HS - HES  
9. RF - Rixson  
10. NO - Norton  
11. SU - Securitron

**Hardware Sets**

Doors: 125A, 125C

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
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<tbody>
<tr>
<td>1 Continuous Hinge (EPD)</td>
<td>CFM83HD1 x Height Required PE</td>
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<tr>
<td>1 Exit Device (storeroom)</td>
<td>LC 8804 Less Pull US32D SA</td>
</tr>
<tr>
<td>1 Cylinder</td>
<td>x Type Required US32D OT</td>
</tr>
<tr>
<td>1 Door Pull (EPD)</td>
<td>RM3312-36 Mtg-Type 1XHD US32D RO</td>
</tr>
<tr>
<td>1 Surf Overhead Stop</td>
<td>9-X36 630 RF</td>
</tr>
<tr>
<td>1 Door Closer (EPD)</td>
<td>281 PD10 EN SA</td>
</tr>
<tr>
<td>1 Threshold</td>
<td>253x3AFG PE</td>
</tr>
<tr>
<td>1 Gasketeting</td>
<td>2891APK TKSP8 PE</td>
</tr>
<tr>
<td>1 Sweep</td>
<td>3452CNB TKSP8 PE</td>
</tr>
<tr>
<td>1 Position Switch</td>
<td>DPS-M / W SU</td>
</tr>
</tbody>
</table>

Notes: Door normally closed, latched and secure.  
Entry by pull when door manually dogged open by hex key in exit device rail or key override.  
Free egress at all times.
Set: 2.0

<table>
<thead>
<tr>
<th>Item</th>
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<td>PE</td>
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<td>1 Conc Overhead Stop</td>
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<td>630</td>
<td>RF</td>
</tr>
<tr>
<td>1 Door Closer (EPD)</td>
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<td>SA</td>
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<tr>
<td>1 Drop Plate</td>
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<td>SA</td>
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<tr>
<td>1 Blade Stop Spacer</td>
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<td>EN</td>
<td>SA</td>
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<td>PE</td>
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<td>PE</td>
</tr>
<tr>
<td>1 Position Switch</td>
<td>DPS-M / W</td>
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<td>SU</td>
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Notes: Door normally closed, latched and secure.
Entry by lever when unlocked by cylinder or key override.
Free egress at all times.
Weatherstripping provided by aluminum door supplier.
<table>
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<tr>
<th>Item</th>
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Notes: Door normally closed, latched and secure. Entry by valid card read or key override. Free egress at all times. Weatherstripping provided by aluminum door supplier. Card reader provided by security contractor.
October 15, 2019

Set: 3.1

Doors: 101A

1 Continuous Hinge (EPD) CFM83SLI-HD1 x Height Required PE
1 Exit Device (storeroom) (EPD) LC AD8504 Less Pull US32D SA
1 Cylinder x Type Required US32D OT
1 Electric Strike (HPD) 9600 630 HS
1 ElectroLynx Adaptor 2004M HS
1 SMART Pac Bridge Rectifier 2005M3 HS
1 Door Pull (EPD) RM3312-36 Mtg-Type 1XHD US32D RO
1 Conc Overhead Stop 1-X36 630 RF
1 Automatic Opener 6330 689 NO
1 Threshold 253x3AFG PE
1 Sweep 3452CNB TKSP8 PE
1 ElectroLynx Harness QC-C1500P (Frame - Strike to Power/Controller) MK
1 Position Switch DPS-M / W SU
1 RF Receiver 539 NO
1 RF Actuator 531 NO
1 Power Supply (EPD) AQD6 SU
1 Set Of Wiring Diagrams 00

Notes: Door normally closed, latched and secure.
Entry by pull when door electrically unlocked as programmed by access control system.
Free egress at all times.
Weatherstripping provided by aluminum door supplier.
### Set: 3.2

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**Notes:** Door normally closed, latched and secure. Entry by valid card read or key override. Free egress at all times. Card reader provided by security contractor.

### Set: 4.0

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### Set: 6.0

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<td>Surface Vert Rod Exit (EPD)</td>
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<td>Electromagnetic Holder</td>
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<td>689</td>
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### Set: 7.0

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<td>Pull Plate (EPD)</td>
<td>BF 111x70C</td>
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<td>2</td>
<td>Surf Overhead Stop</td>
<td>9-X36</td>
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<td>RF</td>
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<td>2</td>
<td>Door Closer (EPD)</td>
<td>281 O</td>
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<td>SA</td>
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<td>2</td>
<td>Kick Plate (EPD)</td>
<td>K1050 10&quot; x 2&quot; LDW 4BE CSK</td>
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<td>RO</td>
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<td>Threshold</td>
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<td>PE</td>
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<tr>
<td>1</td>
<td>Gasketing (EPD)</td>
<td>S773D</td>
<td>PE</td>
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<td>2</td>
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Set: 7.1

Doors: 130

6 Hinge (HPD) TA2714 FT 4-1/2" x 4-1/2" US26D MK
2 Push Plate (EPD) 70C-RKW US32D RO
2 Pull Plate (EPD) BF 111x70C US32D RO
2 Surf Overhead Stop 9-X36 630 RF
2 Surface Closer (EPD) 281 H EN SA
2 Armor Plate (EPD) K1050 34" x 2" LDW CSK BEV US32D RO
1 Threshold 171A PE
1 Gasketing (EPD) S773D PE
2 Sweep (EPD) 18061CNB TKSP PE

Set: 8.0

Doors: 101B

1 Continuous Hinge (EPD) CFM83HD1 x Height Required PE
1 Exit Device (storeroom) LC 8804 Less Pull US32D SA
1 Cylinder x Type Required US32D OT
1 Electric Strike (HPD) 9600 630 HS
1 ElectroLynx Adaptor 2004M HS
1 SMART Pac Bridge Rectifier 2005M3 HS
1 Door Pull (EPD) RM3312-36 Mtg-Type 1XHD US32D RO
1 Door Closer (EPD) 281 P10 EN SA
1 Wall Stop 400 US26D RO
1 ElectroLynx Harness QC-C1500P (Frame - Strike to Power/Controller) MK
1 Position Switch DPS-M / W SU
1 Power Supply (EPD) AQD6 SU
1 Set Of Wiring Diagrams 00

Notes: Door normally closed, latched and secure.
Entry by valid card read or key override.
Free egress at all times.
Card reader provided by security contractor.
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<td>1 Storeroom Lock (EPD)</td>
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<td>1 Electric Strike (HPD)</td>
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<td>1 SMART Pac Bridge Rectifier</td>
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<tr>
<td>1 Kick Plate (EPD)</td>
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<td>1 Wall Stop</td>
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<td>1 ElectroLynx Harness</td>
<td>QC-C1500P (Frame - Strike to Power/Controller)</td>
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**Notes:** Door normally closed, latched and secure.
Entry by valid card read or key override.
Free egress at all times.
Card reader provided by security contractor.

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<td>1 Storeroom Lock (EPD)</td>
<td>LC 8204 LNMD</td>
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<tr>
<td>1 Cylinder</td>
<td>x Type Required</td>
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<tr>
<td>1 Electric Strike (HPD)</td>
<td>1006CLB</td>
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<td>1 ElectroLynx Adaptor</td>
<td>2004M</td>
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<tr>
<td>1 Kick Plate (EPD)</td>
<td>K1050 10&quot; x 2&quot; LDW 4BE CSK</td>
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<td>1 ElectroLynx Harness</td>
<td>QC-C1500P (Frame - Strike to Power/Controller)</td>
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<td>1 Position Switch</td>
<td>DPS-M / W</td>
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<td>1 Door Closer (EPD)</td>
<td>281 CPS</td>
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<tr>
<td>1 Position Switch</td>
<td>DPS-M / W</td>
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**Notes:** Door normally closed, latched and secure.
Entry by valid card read or key override.
Free egress at all times.
Card reader provided by security contractor.

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<td>1 Classroom Lock (EPD)</td>
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**SVPA No. 18079**
Des Moines Fire Station #11
Activity ID 10-2019-001
Des Moines, IA
October 15, 2019

1 Cylinder x Type Required US32D OT
1 Wall Stop 400 US26D RO

Set: 11.1

Doors: 103

3 Hinge (HPD) TA2714 FT 4-1/2" x 4-1/2" US26D MK
1 Storeroom Lock (EPD) LC 8204 LNMD US26D SA
1 Cylinder x Type Required US32D OT
1 Electric Strike (HPD) 1006CLB 630 HS
1 ElectroLynx Adaptor 2004M HS
1 SMART Pac Bridge Rectifier 2005M3 HS
1 Door Closer (EPD) 281 O EN SA
1 Wall Stop 400 US26D RO
1 ElectroLynx Harness QC-C1500P (Frame - Strike to Power/Controller) MK
1 Position Switch DPS-M / W SU
1 Power Supply (EPD) AQD6 SU
1 Set Of Wiring Diagrams 00

Notes: Door normally closed, latched and secure.
Entry when door electrically unlocked by time schedule as programmed by access control system or key override.
Free egress at all times.

Set: 12.0

Doors: 130A

3 Hinge (HPD) TA2714 FT 4-1/2" x 4-1/2" US26D MK
1 Storeroom Lock (EPD) LC 8204 LNMD US26D SA
1 Cylinder x Type Required US32D OT
1 Door Closer (EPD) 281 O EN SA
1 Armor Plate (EPD) K1050 34" x 2" LDW CSK BEV US32D RO
1 Wall Stop 400 US26D RO
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<td>1 Storeroom Lock (EPD)</td>
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<tr>
<td>1 Cylinder</td>
<td>x Type Required US32D OT</td>
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<tr>
<td>1 Electric Strike (HPD)</td>
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<td>1 ElectroLynx Adaptor</td>
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<td>1 SMART Pac Bridge Rectifier</td>
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<td>281 O EN SA</td>
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<tr>
<td>1 Kick Plate (EPD)</td>
<td>K1050 10&quot; x 2&quot; LDW 4BE CSK US32D RO</td>
</tr>
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<td>1 Wall Stop</td>
<td>400 US26D RO</td>
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<td>1 Electric Power Transfer</td>
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Notes: Door normally closed, latched and secure. Entry by valid card read or key override. Free egress at all times. Card reader provided by security contractor.

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Doors: 112A, 113A, 114A, 115A

### Set: 16.0

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<td>1</td>
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<td>RO</td>
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Doors: 128A

### Set: 17.0

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<td>Door Closer (EPD)</td>
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Doors: 102, 122C
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### Doors: 112B, 113B, 114B, 115B

### Set: 19.0

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<tr>
<td>1 Kick Plate (EPD)</td>
<td>K1050 10&quot; x 2&quot; LDW 4BE CSK</td>
<td>US32D  RO</td>
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<tr>
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<td>400</td>
<td>US26D  RO</td>
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<td>1 Gasketing (EPD)</td>
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### Doors: 111

### Set: 20.0

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### Doors: 116A, 116B

### Set: 21.0

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### Doors: 110A, 110B
October 15, 2019

Set: 22.0

Doors: 128

1 Continuous Hinge          HG305 x Height Required  630  MR
1 Multi-Point Lock          FM7325 LNMD 188        US26D  SA
1 Wall Stop                 400                        US26D  RO

Notes: FEMA 361 Door and Frame with EPD.

Set: 23.0

Doors: 129

1 Continuous Hinge          HG305 x Height Required  630  MR
1 Multi-Point Lock          FM7325 LNMD 188        US26D  SA
1 Surf Overhead Stop        9-X36                      630  RF

Notes: FEMA 361 Door and Frame with EPD.

Set: 24.0

Doors: FD101, FD102, FD103, FD104, FD105, FD106

1 Hardware supplied with door  00

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END OF SECTION 087100
SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 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. Exterior windows and entrances.
   2. Interior windows and glazed openings.

1.2 DEFINITIONS
A. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

C. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

D. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.3 PERFORMANCE REQUIREMENTS
A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
      a. Specified Design Wind Loads: not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."
C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer’s published test data, as determined according to procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite 6.0 mm thick and a nominal 1/2-inch-wide interspace.
3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
   a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
      1) Maximum Allowable U-Factor: 0.24 (winter).
      2) Maximum Allowable U-Factor: 0.24 (summer).
      1) Maximum Allowable SHGC: 0.41.

1.4 SUBMITTALS
A. Product Data: For each glass product and glazing material indicated.
B. Samples: 12-inch-square, for each type of glass product indicated, other than monolithic clear float glass.
C. Glazing Schedule: Use same designations indicated on Drawings.
D. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer.

1.5 LEED SUBMITTALS
A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.6 CLOSEOUT SUBMITTALS
A. Maintenance Data.
B. Warranties as specified elsewhere in this Section.

1.7 QUALITY ASSURANCE
A. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing according to ASTM C 1087, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:
B. Glazing for Fire-Rated Door and Window Assemblies: Glazing for assemblies that comply with NFPA 80 and 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 257.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council.

1.8 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer's standard form, made out and signed by coated-glass manufacturer agreeing to replace glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Periods:
      a. Laminated glass: 10 year warranty.
      b. Coated glass: 5 year warranty.
      c. Insulating glass: 10 year warranty.
      d. Fire rated glazing: 5 year warranty.

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 SOURCING

A. Products specified in this section may contribute to the project-wide sourcing requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.3 FABRICATORS

A. Fabricators
   1. Guardian.
   2. Oldcastle.
   3. Pilkington.
   4. Viracon.
   5. Vitro.

2.4 TEMPERED GLASS (TG-1)

A. Tempered Glass: Comply with ASTM C1040 for monolithic tempered glass; ¼ inch total thickness; clear.

B. Tempered Glass shall be installed at all interior locations unless noted otherwise.
2.5 LAMINATED GLASS (LG-1)

A. Glass Type LG-1 by Oldcastle BE.
   1. Laminated Glass: Comply with ASTM C 1172 for kinds of laminated glass indicated and other requirements specified.
      a. Overall Unit Thickness: 5/16 inch.
      b. Thickness of Each Glass Lite: 1/8" (3.0 mm.)
      c. Interlayer Thickness: 0.060” (1.52mm) PVB.
      d. UL 972 Burglary-Resistant rating
      e. LG-1 Interlayer color/opacity: Clear/transparent.
      f. Provide glazing labeling indicating UL 972 assembly compliance
      g. Install at locations as indicated on drawings.

2.6 TRANSPARENT INSULATING-GLASS UNITS (IG-1)

A. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace and complying with ASTM E2190 and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
   1. Provide tempered glass as required by code.
   2. Where tempered glass is not required, provide heat-strengthened float glass.
      a. Glazing supplier shall review contract documents to determine areas of differential shading and shall furnish heat-strengthened glass units as required.
   3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
   4. Sealing System: Dual seal with silicone seal secondary.
   5. Warm-edge spacer: Technoform I-Spacer warm-edge spacer.
      a. Color: Black.

B. Insulating-Glass Unit Assembly and Performance:
   1. Overall Unit Thickness: 1-inch (nominal)
   2. Exterior Glass: ¼" Solarban 72 on Acuity + Acuity Low-E #2
   3. Interspace: ½ inch argon fill
   4. Visible Light Transmittance: 67%
   5. Visible Reflection Out: 13%
   6. Visible Reflection In: 14%
   7. UV Transmission: 8%
   8. Solar Transmission: 25%
   9. Solar Reflection Out: 49%
   10. Winter Nighttime U-Factor: 0.24
   11. Daytime Summer U-Factor: 0.21
   12. Shading Coefficient: .32
   13. Solar Heat Gain Coefficient: 0.28
   14. Relative Heat Gain: 66.2
   15. Light to Solar Gain: 2.39

2.7 INSULATING GLASS SPANDREL UNITS (IGS-1)

A. Insulating Glass Units:
   1) Provide insulated glass units to match IG-1, including all performance characteristics, with ceramic frit coating on #4 surface and insulated aluminum back panel.
   2) Ceramic frit coating color to be selected by Architect from manufacturer’s full range.
   3) Insulating glass spandrel units shall utilize tempered glass, both lites.
2.8 FIRE-RESISTIVE GLAZING (FRG) PRODUCTS

A. Fire-Protection Rating: Ratings as indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

B. Manufacturers:
1. Basis of Design Manufacturer: Safti First.
2. Vetrotech Saint Gobain.

C. Glass Type FRG:
2. 90-minute ratings as indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction. Glazing installer shall verify each opening in which glass is to be installed to confirm whether 120-minute or 90-minute glass is required. See Code Review drawings and door/frame elevations for more information.

3. References:
      2) ASTM E152: Methods for Fire Tests of Door Assemblies.
      5) ASTM E2010-1: Standard Test for Positive Pressure of Fire Tests of Window Assemblies.
   b. National fire Protection Association (NFPA):
      1) NFPA 80: Fire Doors and Windows.
      3) NFPA 252: Fire Tests of Door Assemblies.
      4) NFPA 257: Fire Tests of Window Assemblies.
   c. Underwriters Laboratories, Inc. (UL):
      2) UL 10 B: Standard for Safety of Fire Tests of Door Assemblies.
      3) UL 10 C: Standard of Safety of Positive Pressure Tests of Door Assemblies.

4. System Description
   a. Performance Requirements: Provide a fire rated glazing manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.
      1) Fire rating for glass lites in doors in 1-hr fire walls and 1-hr fire barriers: 45-minutes with hose stream.
      2) Fire rating for glass lites in doors in 2-hr fire walls and 2-hr fire barriers: 90-minutes with hose steam.
      3) Fire rating for glass lites in sidelite, transoms or window assemblies in 2-hr fire walls and 2-hr fire barriers: 120-minutes with hose steam.
      4) Fire resistive, safety rated glazing tested in accordance with ASTM E119, NFPA 80, NFPA 251, NFPA 252, NFPA 257, UL 9, UL 10B, UL 10C and UL 263.
5) Testing Laboratory: Fire tests shall be conducted by a nationally recognized independent testing laboratory.

b. Listings and Labels:
1) Fire rated glazing shall be under current follow-up services by a nationally recognized independent testing laboratory approved by OSHA and maintain a current listing or certification. Assemblies shall be labeled in accordance with limits of listings.

5. Products:
a. Glass Type FRG-20 MIN:
1) For glass lites in doors in 30-minute fire partitions
2) Product: SuperLite I 20-minute fire-resistive glazing as manufactured by SaftiFirst.
3) Vision kits:
   a) Wood doors: Moulding VT1 with fire clips as manufactured by VT Industries; refer to specification section 08 14 16 – Flush Wood Doors.
   b) Hollow metal doors/frames: Manufacturer’s standard low-profile vision kit with U.L. listing for rated assemblies; refer to specification section 08 11 13 – Hollow Metal Doors and Frames.

6. Product Requirements:
a. Single Source Limitation: Fire rated glass and framing must be provided by a single-source, US manufacturer. Distributors of fire rated glass and framing are not to be considered as manufacturers.

b. Requirements:
1) Make-up: Must be comprised of an inboard and outboard lite of clear tempered glass protecting a clear, fire resistive, intumescent interlayer.
2) Thickness: 1-1/2” (39 mm) standard profile.
3) Weight: 12 lbs./sq. ft. in 1-1/2” (39 mm) standard profile.
4) Dimensions: Must meet max. clear view area of 4,876 sq. in., measuring at least 124 in. on the long side. See door frame elevations for specific dimensions at doors requiring fire-resistive glazing.
5) Sound Transmission Rating: Must provide a minimum of STC 44 Rating in 1-1/2” (39 mm) standard profile.
6) Appearance: Must be tint-free, optically clear fire rated glazing.
7) Fire Rating: Must be fire rated to 90 minutes with hose stream and meet ASTM E-119.
9) Glazing with EPDM tape or other listed flame-resistant gasket material and calcium silicate setting blocks.
10) Glazing shall be installed in an equally rated framing system.

c. Manufacturer’s Fire Rating Glazing Material:
1) Each piece of fire-rated glazing material shall be labeled with a permanent logo including name of product, manufacturer, testing laboratory, fire rating period and safety glazing standards.
2) Glazing materials installed in Hazardous Locations, subject to human impact, shall be certified and permanently labeled as meeting applicable requirements reference in NFPA 80:
   a) CPSC 16 CFR 1201 Cat. I & II.
2.9 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   2. EPDM, ASTM C 864.
   4. Thermoplastic polyolefin rubber, ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
   1. Neoprene.
   2. EPDM.
   4. Thermoplastic polyolefin rubber.

2.10 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:
   1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
   1. Neutral-Curing Silicone Glazing Sealants
      a. Available Products:
         1) Dow Corning 795 or 799 or equivalent product.

C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.11 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 804.3 tape, where indicated.
   2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
   1. Type 1, for glazing applications in which tape acts as the primary sealant.
   2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.12 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

H. Outside Corner Conditions: Vertical corner aluminum break metal shape, 0.040 thickness, flush with the outside face of glazing units on either side of the corner. Outside lites to extend to corner as much as possible. Finish to match Aluminum Composite Panel Color 1.

2.13 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 GLAZING

A. General: Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
1. 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.
2. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
4. Install setting blocks in sills 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.
5. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
6. Provide spacers for glass lites where length plus width is larger than 50 inches.
7. 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.

B. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
1. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
2. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
3. Apply heel bead of elastomeric sealant.
4. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
5. Apply cap bead of elastomeric sealant over exposed edge of tape.

C. Gasket Glazing (Dry): Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
1. 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.
2. 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.
3. Install gaskets so they protrude past face of glazing stops.

D. Sealant Glazing (Wet): Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
1. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
2. Tool exposed surfaces of sealants to provide a substantial wash away from glass.
3.2 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 08 80 00
SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:
   1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
   2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.2 SUBMITTALS

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

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. Sound Transmission Characteristics: For STC-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Installer to verify minimum sizes indicated meet code requirements for all framing conditions.

PART 2 - PRODUCTS

2.1 RECYCLED CONTENT

A. Products specified in this section contribute to the project-wide requirements for Recycled Content described in Section 0 81 13.14 “Sustainable Design Requirements”.

2.2 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

2.3 SUSPENSION SYSTEM COMPONENTS

A. 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.
B. Hanger Attachments to Concrete:
1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers 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 an independent testing agency.
   a. Type: Postinstalled, chemical anchor or postinstalled, expansion anchor.
2. 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 an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
1. Depth: 1-1/2 inches.

E. Furring Channels (Furring Members):
1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
2. Steel Studs: ASTM C 645.
   a. Minimum Base-Metal Thickness: 0.033 inch (20 gauge).
   b. Depth: As indicated on Drawings.
   a. Minimum Base Metal Thickness: 0.033 inch (20 gauge).
4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
   a. Configuration: Asymmetrical or hat shaped.

F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   b. Chicago Metallic Corporation; Drywall Furring System.
   c. USG Corporation; Drywall Suspension System.

2.4 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.027 inch (22 gauge).

B. Slip-Type Head Joints: Where indicated, provide the following:
1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
   a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      1) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
      2) Superior Metal Trim; Superior Flex Track System (SFT).
C. Firestop Track: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

E. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
   1. Depth: 1-1/2 inches.
   2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base Metal Thickness: 0.0179 inch.
   2. Depth: 7/8 inch.

G. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
   1. Configuration: Asymmetrical or hat shaped.

H. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
   1. Depth: 3/4 inch.
   2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
   3. 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.

I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.5 AUXILIARY MATERIALS

A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
   1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
   2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
   3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
   4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
3.2 INSTALLING SUSPENSION SYSTEMS

A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

B. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Do not attach hangers to steel roof deck.
   4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
   5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

C. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb, unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
      c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

6. Curved Partitions:
   a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
   b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

C. Direct Furring:
   1. Screw to wood framing.
   2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

D. Z-Furring Members:
   1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches o.c.
   2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
   3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16
SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior gypsum board.
   2. Tile backing panels: See Section 09 30 00.

1.2 SUBMITTALS

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

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products
   used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and
   construction identical to those tested in assembly indicated according to ASTM E 119 by an
   independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction
   identical to those tested in assembly indicated according to ASTM E 90 and classified according
   to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 MATERIAL OPTIMIZATION

A. Products specified in this section have been identified to have a published Environmental
   Product Data (EPD) Declaration and/or published Material Ingredient (HPD+). Project-wide
   requirements are described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81
   13.14 “Sustainable Design Requirements”.

2.3 SOURCING

A. Products specified in this section contribute to the project-wide sourcing requirements as
   described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.4 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 1396/C 1396M, as applicable to type of gypsum board
   indicated and whichever is more stringent.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Gypsum Co.
   b. CertainTeed Gypsum Inc.
   c. G-P Gypsum.
   e. USG Corporation.

B. Regular Type:
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

C. Type X:
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

D. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.
   3. Provide Type X unless noted otherwise on drawings.

E. Moisture and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch, Type X.
   2. Long Edges: Tapered.
   3. Install at the following locations:
      a. All restrooms where gypsum board is required
      b. All areas within 4'-0" of plumbing fixtures including sinks, water closets, urinals, lavatories, drains, etc.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. L-Bead: L-shaped; exposed long flange receives joint compound.
      e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      f. Expansion (control) joint.
      g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
D. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.
B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
D. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
E. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

3.2 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Regular Type: As indicated on Drawings.
   2. Type X: As indicated on Drawings.
   3. Ceiling Type: Ceiling surfaces.
3.3 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners.
   2. Bullnose Bead: Use at outside corners.
   3. LC-Bead: Use at exposed panel edges.
   4. U-Bead: Use at exposed panel edges.

3.4 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
      a. Primer and its application to surfaces are specified in other Division 09 Sections.

3.5 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00
SECTION 09 30 00
TILING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Porcelain floor tile.
   2. Porcelain wall tile.
   3. Glazed wall tile.
   4. Tiled Niche.
   5. Waterproof membrane for thin-set tile installations.
   7. Cementitious backer units installed as part of tile installations.
   8. Metal edge strips installed as part of tile installations.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints.

C. Samples:
   1. Each type, composition, color, and finish of tile.
   2. Assembled samples with grouted joints for each type, composition, color, and finish of tile.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 CLOSEOUT SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, color, and finish indicated.

PART 2 - PRODUCTS

2.1 MATERIAL OPTIMIZATION

A. Products (cementitious backer board, mortar, grout, and waterproofing membrane) specified in this section have been identified to have a published Environmental Product Data (EPD) Declaration and/or and published Material Ingredient (HPD+). Project-wide requirements are described in Section 01 81 13.14 “Sustainable Design Requirements”. 
2.2 **AIR QUALITY**

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 "Sustainable Design Requirements".

2.3 **MANUFACTURERS**

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Basis-of-Design Product: The design for each tile type is based on the product named. Subject to compliance with requirements, provide either the named product. See Finish Schedule for product manufacturers and patterns.

2.4 **TILE PRODUCTS**

A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

B. Porcelain Floor & Wall Tile: Flat tile as follows:
   2. Products: See finish schedule.

C. Glazed Wall Tile: Flat tile as follows:
   1. Module Size: See drawings.
   2. Products: See finish schedule.

D. Porcelain Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing where applicable.
   1. Base: see drawings.
   2. External Corners: Bullnose.
   3. Internal Corners: Field-butted square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.

2.5 **ACCESSORY MATERIALS**

A. Waterproofing and Crack-Suppression Membranes for Thin-Set Tile Installations: Manufacturer's standard product that complies with ANSI A118.10 and ANSI A118.12, selected from the following.
   1. Chlorinated-Polyethylene-Sheet Product: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric, 0.030-inch nominal thickness.
      a. Available Product: Noble Company (The); Chloraloy.
         1) Use at all shower floors and any other location recommended by manufacturer.
         2) Provide pre-formed corners to minimize potential for leaks.
      b. Available Product: Nobel Company (The); NobleSeal TS.
         1) Use at all wet locations other than shower floors.
   2. PVC-Sheet Product: Two layers of PVC sheet heat-fused together and to facings of bondable nonwoven polyester, 0.040-inch nominal thickness.
      a. Available Product: Compotite Corporation; Composeal Gold.
      b. Use at all slab on grade tile installations.
3. Polyethylene-Sheet Product: Polyethylene membrane faced on both sides with polypropylene fleece webbing, 0.008-inch nominal thickness.
   a. Available Product: Schluter Systems L.P.; KERDI.
   b. Use at all wet locations other than shower floors.

   a. Available Products:
      1) Boiardi Products Corporation; Elastiment 323.
      2) MAPEI Corporation; PRP 315.
      3) Southern Grouts & Mortars, Inc.; Southcrete 1100.
      4) TEC Specialty Products Inc.; TA-324, Triple Flex.

5. Urethane Waterproofing and Tile-Setting Adhesive: One-part liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   a. Available Products:
      1) Bostik; Hydroment Ultra-Set.
      2) Southern Grouts & Mortars, Inc.; Deck-Seal 1000.

6. Use construction adhesive at stair riser condition on metal substrate as recommended by manufacturer.

7. Tiled Niche
   a. Basis of Design: Nobel Niche, 301
      1) See drawings for locations

2.6 SETTING AND GROUTING MATERIALS

A. Available Manufacturers:
   1. Custom Building Products.
   2. LATICRETE International Inc.
   3. MAPEI Corporation.

B. Standard Dry-Set Cement Mortar (Thin Set): ANSI A118.1.
   1. For wall applications, provide nonsagging mortar.

C. Modified Dry-Set Cement Mortar (Thin Set): ANSI A118.4.
   1. Prepackaged dry-mortar mix containing dry additive to which only water must be added.
   2. Prepackaged dry-mortar mix combined with liquid-latex additive.
   3. For wall applications, provide nonsagging mortar.

D. Dry Set Mortar for Large and Heavy Tile (LHT Mortar), formerly Medium Bed Mortar: ANSI 118.1.
   1. Large and Heavy Tile Definition: Tiles with at least one side greater than 15” long.

E. Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Water-Cleanable, Tile-Setting Epoxy Adhesive: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Standard Sanded Cement Grout: ANSI A118.6, color as indicated. Use at grout joints 1/8’ or more.
H. Standard Unsanded Cement Grout: ANSI A118.6, color as indicated. Use at grout joints 1/8’ or less.

I. Polymer-Modified Tile Grout: ANSI A118.7, color as indicated. Use at glass mosaic tile.
   1. Polymer Type: Dry, redispersible form, prepackaged with other dry ingredients.
   2. Polymer Type: Liquid-latex form for addition to prepackaged dry-grout mix.

2.7 MISCELLANEOUS MATERIALS

A. Elastomeric Sealants: Elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 07 Section "Joint Sealants."
   1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. One-Part, Mildew-Resistant Silicone: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for in-service exposures of high humidity and extreme temperatures.
      a. Available Products:
         1) Dow Corning Corporation; Dow Corning 786.
         2) GE Silicones; Sanitary 1700.
         3) Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
         4) Tremco, Inc.; Tremsil 600 White.

   3. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
      a. Available Products:
         1) Bostik; Chem-Calk 550.
         3) Pecora Corporation; NR-200 Urexpan.
         4) Tremco, Inc.; THC-900.

B. Cementitious Backer Units: ANSI A118.9 in maximum lengths available to minimize end-to-end butt joints.
   1. Thickness: 1/2 inch.
   2. Available Products:
      a. Custom Building Products; Wonderboard
      b. National Gypsum; PremaBase Cement Board.
      c. USG Corporation; DUROCK Cement Board.

C. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials.

D. Metal Edge Strips: Angle or L-shape, satin anodized aluminum exposed-edge material.

E. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
B. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions.

C. Remove protrusions, bumps, and ridges by sanding or grinding.

D. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

E. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.2 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.


C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Grind cut edges of tile abutting trim, finish, or built-in items. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Locate joints in tile surfaces directly above joints in concrete substrates.
   2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

H. Grout tile to comply with requirements of ANSI A108.10, unless otherwise indicated.
   1. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

I. At showers, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11.

J. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
1. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

K. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
   1. Tile floors in wet areas.
   2. Tile floors in laundries/warewash & kitchens.
   3. Tile floors composed of tiles 8 by 8 inches or larger.
   4. Tile floors composed of rib-backed tiles.

L. Install tile on floors with the following joint widths: unless noted otherwise by product manufacturer.
   3. Thin (3-5 mm) porcelain tile: 1/16 inch.

M. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

N. Install metal lath and scratch coat for walls to comply with ANSI A108.1A, Section 4.1.

O. Install tile on walls with the following joint widths: unless noted otherwise by product manufacturer.
   2. Glazed Wall Tile: 1/16 inch.

P. Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.3 FLOOR TILE INSTALLATION SCHEDULE

A. Interior floor installation on concrete; thin-set mortar; TCA F113.
   1. Thin-Set Mortar: Modified dry-set cement mortar.
   2. LHT Mortar required at large and heavy tile.

B. Interior floor installation on waterproof membrane over concrete; thin-set mortar; TCA F122.
   1. Thin-Set Mortar: Modified dry-set cement mortar.
   2. LHT Mortar required at large and heavy tile.

3.4 WALL TILE INSTALLATION SCHEDULE

A. Interior wall installation over masonry or concrete; cement mortar bed (thickset); TCA W201.
   2. Grout: Polymer-modified sanded grout.

B. Interior wall installation over masonry or concrete; thin-set mortar; TCA W202.
   1. Thin-Set Mortar: Modified dry-set cement mortar.
   2. LHT Mortar required at large and heavy tile.
C. Interior wall installation over solid backing and solid anchorage for metal lath; cement mortar bed (thickset); TCA W221.
   2. LHT Mortar required at large and heavy tile.

D. Interior wall installation over glass-mat, water-resistant backer board; thin-set mortar; TCA W245.
   1. Thin-Set Mortar: Modified dry-set cement mortar.
   2. LHT Mortar required at large and heavy tile.

E. Interior wall and shower-receptor installation; thin-set mortar; over cementitious backer units; TCA B415 and TCA W244.
   1. Thin-Set Mortar: Modified dry-set cement mortar.
   2. LHT Mortar required at large and heavy tile.

END OF SECTION 09 30 00
SECTION 09 51 23
ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes acoustical tiles and concealed suspension systems for ceilings.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include product test reports and research/evaluation reports.

B. Coordination Drawings: Drawn to scale and coordinating acoustical tile ceiling installation with hanger attachment to building structure and ceiling mounted items. Show size and location of initial access modules.

C. Samples: For each exposed finish.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Units: Full-size tiles equal to 2.0 percent of quantity installed.
   2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2.0 percent of quantity installed.

1.5 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory.

B. Fire-Test-Response Characteristics:
   1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
      a. Identify materials with appropriate markings of applicable testing and inspecting agency.
   2. Surface-Burning Characteristics: Acoustical tiles complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84.
      a. Smoke-Developed Index: 450 or less.
PART 2 - PRODUCTS

2.1 MATERIAL OPTIMIZATION

A. Products specified in this section have been identified to have a published Environmental Product Data (EPD) Declaration and/or and published Material Ingredient (HPD+). Project-wide requirements are described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 SOURCING

A. Products specified in this section contribute to the project-wide sourcing requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.3 RECYCLED CONTENT

A. Products specified in this section contribute to the project-wide requirements for Recycled Content described in Section 0 81 13.14 “Sustainable Design Requirements”.

2.4 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.5 ACOUSTICAL TILE CEILINGS, GENERAL

A. Acoustical Tile Standard: Comply with ASTM E 1264.

B. Metal Suspension System Standard: Comply with ASTM C 635.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Anchors in Concrete: Cast-in-place anchors fabricated from corrosion-resistant materials, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
   2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

E. Seismic struts and seismic clips.

F. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements;
formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.6 MANUFACTURERS

A. Ceiling Tile ACT1:
   1. USG Millennia High NRC
   2. Size: 24" x 24" unless noted otherwise in drawings
   3. Edge Detail: Shadow Line Tapered Edge
   5. Substitutions: Allowed in accordance with Section 00 26 00.

2.7 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING

A. Metal Suspension System Standard: Provide manufacturer's standard 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.

D. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
   1. Postinstalled Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

F. 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 tile 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.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Armstrong World Industries, Inc.
      b. Celotex Corporation (The); Building Products Division; Architectural Ceilings Marketing Dept.
      c. Chicago Metallic Corporation.
      d. USG Interiors, Inc.

G. Basis of Design:
   1. Available products include the following:

SVPA No. 18079
Des Moines Fire Station #11
Activity ID 10-2019-001
Des Moines, IA
a. Armstrong “Prelude”, 9/16 inch, exposed tee grid system.
b. USG Donn DXT/DXLT 9/16”.
c. Substitutions allowed in accordance with Section 00 26 00.

2. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepaemented, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G01 coating designation; other characteristics as follows:

3. Access: Upward, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and structural framing to which acoustical tile 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 tile ceilings.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other Sections.

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width units at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical tile ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
   2. U.B.C.'s "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings":

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
   4. Do not attach hangers to steel deck tabs.
5. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.
   1. 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.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
   1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.

3.4 CLEANING

A. Clean exposed surfaces of acoustical tile 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 tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23
SECTION 09 65 66
RESILIENT ATHLETIC 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. This Section includes the following:
   1. Rubber sheet floor covering.

B. Related Sections include the following:
   1. Section 01 81 13.14 “Sustainable Design Requirements”.
   2. Division 09 Sections for resilient floor coverings installed in areas other than athletic-activity spaces.
   3. Division 09 Section "Resilient Base and Accessories" for wall base and accessories installed with floor coverings.

1.3 SUBMITTALS

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

B. Shop Drawings: Show installation details and locations of the following:
   1. Floor patterns.
   2. Seam locations.

C. Qualification Data: For sheet rubber floor covering Installer.

1.4 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.5 QUALITY ASSURANCE

A. Sheet Rubber Installer Qualifications: An experienced installer who has completed sheet rubber floor covering installations using seaming methods indicated for this Project and similar in material, design, and extent to that indicated for this Project, who is acceptable to manufacturer, and whose work has resulted in installations with a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.

B. Store materials to prevent deterioration. Store rolls upright.
1.7 PROJECT CONDITIONS

A. Adhesively Applied Products:
   1. Maintain temperatures within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor coverings during the following time periods:
      a. 48 hours before installation, unless longer period is recommended in writing by manufacturer.
      b. During installation.
      c. 48 hours after installation, unless longer period is recommended in writing by manufacturer.
   2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
   3. Close spaces to traffic during floor covering installation.
   4. Close spaces to traffic for 48 hours after floor covering installation, unless manufacturer recommends longer period in writing.

B. Install floor coverings after other finishing operations, including painting, have been completed.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor coverings to include in maintenance manuals.

B. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Sheet Floor Coverings: Furnish full-width rolls of not less than 10 linear feet for each 500 linear feet or fraction thereof, of each type, color, and pattern of floor covering installed.

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 RECYCLED CONTENT

A. Products specified in this section contribute to the project-wide requirements for Recycled Content described in Section 0 81 13.14 “Sustainable Design Requirements”.

2.3 SOURCING

A. Products specified in this section contribute to the project-wide sourcing requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.4 RUBBER SHEET FLOOR COVERING

A. Products: Subject to compliance with requirements, provide the following:
   1. Basis of Design: Ecore
   2. Substitutions: Allowed in accordance with Section 00 26 00.
B. Material: Recycled-rubber compound.

C. Installation Method: Adhered.

D. Traffic-Surface Texture: Smooth

E. Roll Size: Not less than 48 inches wide by longest length that is practical to minimize splicing during installation.

F. Thickness: 9 mm.

G. Color and Pattern: See finish schedule and key.

H. Accessories:
   2. Installation Adhesive: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.

2.5 ACCESSORIES

A. Provide manufacturer’s recommended transition strips to adjacent floor coverings specified. Submit transition strips for Architect approval.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity and Adhesion Testing: Perform tests recommended in writing by manufacturer. Proceed with installation only after substrates pass testing.
   3. Moisture Testing:
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      1) Perform tests so that each test area does not exceed 200 sq. ft. and perform not less than 2 tests in each installation area and with test areas evenly spaced in installation areas.
b. Perform tests recommended in writing by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation, unless manufacturer recommends a longer period in writing.
   1. Do not install floor coverings until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOOR COVERING INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Scribe, cut, and fit floor coverings to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

C. Extend floor coverings into toe spaces, door reveals, closets, and similar openings, unless otherwise indicated.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on floor coverings. Use nonpermanent, nonstaining marking device.

E. Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and floor covering manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
   1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 SHEET FLOOR COVERING INSTALLATION

A. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.

B. Lay out sheet floor coverings as follows:
   1. Maintain uniformity of floor covering direction.
   2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
   3. Match edges of floor coverings for color shading at seams.
   4. Avoid cross seams.

C. Seams: Prepare and finish seams to produce surfaces flush with adjoining floor covering surfaces.
   1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering.
2. Chemically Bonded Seams: Comply with ASTM F 693. Seal seams to prevent openings from forming between cut edges and to prevent penetration of dirt, liquids, and other substances into seams.

3.5 FIELD-APPLIED FINISHES

A. Apply finish according to manufacturer's written instructions to produce a sealed surface that is ready for use.

B. Do not cover floor coverings after finishing until finish reaches full cure.

3.6 CLEANING AND PROTECTING

A. Perform the following operations immediately after completing floor covering installation:
   1. Remove adhesive and other blemishes from floor covering surfaces.
   2. Sweep and vacuum floor coverings thoroughly.
   3. Damp-mop floor coverings to remove marks and soil.
      a. Do not wash floor coverings until after time period recommended in writing by manufacturer.

B. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
   1. Do not move heavy and sharp objects directly over floor coverings. Protect floor coverings with plywood or hardboard panels to prevent damage from storing or moving objects over floor coverings.

END OF SECTION 09 65 66
SECTION 09 68 13
TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes modular carpet tile.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Show the following:
   1. Carpet tile type, color, and dye lot.
   2. Pattern of installation.
   3. Insets and borders.
   4. Edge, transition, and other accessory strips.
   5. Transition details to other flooring materials.

C. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Warranty as specified elsewhere in this Section.

C. Furnish extra materials described below, before installation begins, 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.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.7 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, “Site Conditions; Temperature and Humidity” and Section 7.12, "Ventilation."
B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

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.

1.8 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 "Sustainable Design Requirements".

2.2 CARPET TILE: CPT

A. Available Products: See Finish Schedule for products, colors, and patterns.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Confirm proper moisture content per manufacturer's recommended method. Provide mitigation if concrete moisture is above manufacturer limits.

C. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
D. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

E. Install pattern parallel to walls and borders.

END OF SECTION 09 68 13
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes carpet tile entrance mats and installation.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation methods.

B. Shop Drawings: Show the following:
   1. Carpet tile type, color, and dye lot.
   2. Type of installation.
   3. Pattern of installation.
   4. Type, color, and location of edge, transition, and other accessory strips.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tile to include in maintenance manuals specified in Division 1. 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.

B. Warranty as specified elsewhere in this Section.

C. Furnish extra materials described below, before installation begins, 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 3 percent of amount installed for each type indicated, but not less than 10 sq. yd.
   2. Deliver extra stock material neatly bundled and clearly labeled to Owner at project closeout.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
C. **Product Options:** Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered. Refer to Division 1 Section "Substitutions."

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

### 1.7 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

B. Environmental Limitations: Do not install carpet tile until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet tile 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.

### 1.8 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. Special Carpet Tile Warranty: Written warranty, signed by carpet tile manufacturer agreeing to replace carpet tile that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

1. **Warranty Period:** 10 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MATERIAL OPTIMIZATION

A. Products specified in this section have been identified to have a published Environmental Product Data (EPD) Declaration and/or and published Material Ingredient (HPD+). Project-wide requirements are described in Section 01 81 13.14 “Sustainable Design Requirements”.

#### 2.2 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

#### 2.3 CARPET TILE

A. Product: "Step Repeat" as manufactured by Interface, substitutions not allowed.

1. **Installation:** Quarter Turn
2. Color: See drawings (Finish Key)

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and that is recommended by carpet tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Verify that substrates and conditions are satisfactory for carpet tile 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 carpet tile manufacturer.
   2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. 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 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, 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, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 13, "Carpet Modules (Tiles)."

B. Installation Method: Glue-down; install every tile with releasable adhesive.
C. 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.

D. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

E. 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.

F. Install pattern parallel to walls and borders.

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.

B. Protect installed carpet tile to comply with CRI 104, Section 15, "Protection of 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 09 68 20
SECTION 09 90 00
PAINTS AND COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES
A. Surface preparation and field painting of exposed interior items and surfaces.
B. Surface preparation and field painting of exposed exterior items and surfaces.
C. Painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

1.2 RELATED SECTIONS
A. Section 01 81 13.14 “Sustainable Design Requirements”.
B. Section 03 30 00 - Cast-in-Place Concrete.
C. Section 05 50 00 - Metal Fabrications.
D. Section 06 42 00 – Interior Architectural Wood Work: Shop priming architectural woodwork.
E. Section 08 11 13 - Hollow Metal Doors and Frames.
F. Section 09 29 00 - Gypsum Board Assemblies.

1.3 REFERENCES
B. Steel Structures Painting Council (SSPC) SP6 - Commercial Blast Cleaning Procedures.
C. Steel Structures Painting Council (SSPC) SP10 - Near White Blast Cleaning Procedure.

1.4 DEFINITIONS
A. General: Standard coating terms defined in ASTM D 16.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85 degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60 degree meter.
3. Semi-gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60 degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60 degree meter.
B. Environments: The following terms distinguish between different corrosive exposures:
1. “Severe environments” are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using strong
chemicals. Environments with heavy concentrations of strong chemical fumes and frequent splashing and spilling of harsh chemical products are severe environments.

2. "Moderate environments" are corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development, and regular cleaning with strong chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.

3. "Mild environments" are industrial atmospheres with normal exposure to moderate humidity and condensation, occasional mold and mildew development, and infrequent cleaning with strong chemicals. Environments with low levels of mild chemical fumes and occasional splashing and spilling of chemical products are mild environments. Normal outdoor weathering is also considered a mild environment.

1.5 SUBMITTALS

A. Submit under provisions of Division 1 Specifications.

B. Product Data for each paint system indicated, including:
   1. Material List: An inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Preparation instructions and recommendations.
   3. Manufacturer’s Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
   4. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.

1.6 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. All materials, preparation and workmanship shall conform to requirements of the latest edition of the Architectural Painting Specification Manual by the Master Painters Institute (MPI) as issued by the location MPI Accredited Quality Assurance Association having jurisdiction.

C. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

D. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

E. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label:

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45°F (7°C). Maintain storage containers 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.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90°F (10 and 32°C).

C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95°F (7 and 35°C).

D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5°F (3°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.

1.10 CLOSEOUT SUBMITTALS

A. Furnish extra paint materials from the same production run as the materials applied and in quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
   1. Quantity: Furnish Owner with an additional three percent, but not less than 1 gal (3.8 l) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.1 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 MATERIAL OPTIMIZATION

A. Products specified in this section have been identified to have a published Environmental Product Data (EPD) Declaration and/or and published Material Ingredient (HPD+). Project-wide requirements are described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.3 MANUFACTURERS

A. Basis of Design: PPG Paints or approved equal.
B. Other acceptable suppliers:
   1. Sherwin Williams
   2. Benjamin Moore
   3. Diamond Vogel

2.4 PAINT MATERIALS - GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that meet the applicable local, state or federal VOC requirements.

C. Color: Refer to Finish Schedule and Paint Legend for paint colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   3. Wood: 15 percent.
   4. Gypsum Board: 12 percent.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.
   2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
      a. Confirmation of primer’s suitability for expected service conditions.
      b. Confirmation of primer’s ability to be top coated with materials specified.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning. 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 primers and reprime substrate.
   2. **Cementitious Substrates:** Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. 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 to prepare surfaces.
      a. Use abrasive blast-cleaning methods if recommended by coating 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 coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
   3. **Wood Substrates:** Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view 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.
      b. Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.
      c. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   4. **Ferrous Metal Substrates:** Clean un-galvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
      a. Blast-clean steel surfaces as recommended by coating manufacturer and according to 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, solvent clean, and touch up with same primer as the shop coat.
   5. **Nonferrous-Metal Substrates:** Clean nonferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.
      a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. **Material Preparation:** Carefully mix and prepare coating materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
   2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
   3. Use only the type of thinners approved by manufacturer and only within recommended limits.
   4. **Tinting:** Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the
finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

### 3.3 APPLICATION

**A. General:** Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

**B. Application Procedures:** Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. The number of coats and film thickness required is the same regardless of application method.
2. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

**C. 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. For wood finishes, varnishes, and epoxies, sand and dust between each coat to provide an anchor for next coat and remove defects visible from distance up to 39" or as recommended by manufacturer.
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.

**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. Mechanical items to be painted include, but are not limited to, the following:**
1. Piping, pipe hangers, and supports.
2. Tanks.
3. Motors and mechanical equipment.
4. Accessory items.

**G. Electrical items to be painted include, but are not limited to, the following:**
1. Conduit and fittings.
2. Switchgear.
3. Panelboards.

**H. Completed Work:** Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.
3.4 CLEANING
   A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

3.5 FIELD QUALITY CONTROL
   A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
      1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
   B. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.6 CLEANING
   A. After completing painting, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.7 PROTECTION
   A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
   B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
   C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

PAINT AND COATING SCHEDULE

3.8 EXTERIOR PAINTING SCHEDULE
   A. Concrete Substrates, Nontraffic Surfaces:
      1) Latex System:
         a) Prime Coat: Primer, alkali resistant, water based.
            1) PPG Paints 4-603 PERMA-CRETE Interior/Exterior Alkali Resistant Primer
            2) Sherwin-Williams LOXON Concrete & Masonry Primer Sealer, A24 Series
            3) Diamond Vogel Weather-Plate Exterior 100% Acrylic Latex Primer
         b) Topcoat: Latex, exterior, semi-gloss.
            1) PPG Paints 6-900XI Speedhide Exterior Semi-Gloss
            2) Sherwin-Williams DuraCraft Acrylic Latex Exterior, C14 Series
            3) Diamond Vogel PermAcryl Exterior 100% Acrylic Latex
2) High-Build Latex System:
   a) Prime Coat: As recommended in writing by topcoat manufacturer.
   b) Topcoat: Latex, exterior, high build.
      1) PPG Paints 4-22 Perma-Crete High Build 100% Acrylic Topcoat
      2) Sherwin-Williams LOXON Acrylic Coating A24 Series
      3) Diamond Vogel Permaflex Elastomeric Coating

B. CMU Substrates:
1) Latex System: Prime to pinhole free finish.
   a) Prime Coat: Block filler, latex, interior/exterior.
      1) PPG Paints 6-15 Speedhide Int/Ext Masonry Hi Fill Latex Block Filler
      2) Sherwin-Williams PrepRite Block Filler, B25W25
      3) Diamond Vogel UniFill Acrylic Block Filler
   b) Topcoat: Latex, exterior, semi-gloss.
      1) PPG Paints 6-900XI Speedhide Exterior Semi-Gloss
      2) Sherwin-Williams DuraCraft Acrylic Latex Exterior, C14 Series
      3) Diamond Vogel PermAcryl Exterior 100% Acrylic Latex

2) Latex over Alkali-Resistant Primer System: Prime to pinhole free finish.
   a) Prime Coat: Primer, alkali resistant, water based.
      1) PPG Paints 4-603 Perma-Crete Int/Ext Alkali Resistant Primer
      2) Sherwin-Williams LOXON Concrete & Masonry Primer Sealer, A24 Series
      3) Diamond Vogel Weather-Plate Exterior 100% Acrylic Latex Primer
   b) Topcoat: Latex, exterior, semi-gloss.
      1) PPG Paints 6-900XI Speedhide Exterior Semi-Gloss.
      2) Sherwin-Williams DuraCraft Acrylic Latex Exterior, C14 Series
      3) Diamond Vogel PermAcryl Exterior 100% Acrylic Latex

3) High-Build Latex System:
   a) Prime Coat: As recommended in writing by topcoat manufacturer.
   b) Topcoat: Latex, exterior, high build.
      1) PPG Paints 4-22 Perma-Crete High Build 100% Acrylic Topcoat.
      2) Sherwin Williams LOXON Acrylic Coating A24 Series
      3) Diamond Vogel Permaflex Elastomeric Coating

C. Steel and Iron Substrates:
1) Alkyd System:
   a) Prime Coat: Primer, alkyd, anticorrosive, for metal.
      1) PPG Paints Devguard 4360 Rust Inhibitive Primer.
      2) Sherwin-Williams KEM BOND HS Alkyd Primer, B50 Series
      3) Diamond Vogel Iron Prime 250 Fast Dry Primer
   b) Topcoat: Alkyd, exterior, semi-gloss.
      1) PPG Paints Devguard 4306 Alkyd Semi-Gloss Enamel.
      2) Sherwin-Williams DTM Alkyd Enamel, B55 Series
      3) Diamond Vogel CoteAll Multi-Purpose Alkyd Enamel

D. Galvanized-Metal Substrates:
1) Latex System:
   a) Prime Coat: Primer, galvanized, water based.
      1) PPG Paints 90-912 Pitt Tech Plus 100% Acrylic DTM Primer.
      2) Sherwin-Williams DTM Acrylic Primer/Finisher, B66 Series
3) Diamond Vogel Vers-Acryl 200 Acrylic Maintenance Primer-Finish

b) Topcoat: Latex, exterior, semi-gloss.
   1) PPG Paints 6-900XI Speedhide Exterior Semi-Gloss.
   2) Sherwin-Williams DuraCraft Acrylic Latex Exterior, C14 Series
   3) Diamond Vogel PermAcryl Exterior 100% Acrylic Latex

E. Aluminum Substrates:
   1) Latex System:
      a) Prime Coat: Primer, quick dry, for aluminum.
         1) PPG Paints: 17-921 Seal Grip Primer.
         2) Sherwin-Williams Multi-Purpose Interior/Exterior Latex Primer, B51 Series
         3) Diamond Vogel Diamond Prime Universal Interior/Exterior Primer
      b) Topcoat: Latex, exterior, semi-gloss.
         1) PPG Paints 6-900XI Speedhide Exterior Semi-Gloss.
         2) Sherwin-Williams DuraCraft Acrylic Latex Exterior, C14 Series
         3) Diamond Vogel PermAcryl Exterior 100% Acrylic Latex

F. Stainless-Steel Substrates:
   1) Latex System:
      a) Prime Coat: Primer, bonding, solvent based.
         1) PPG Paints 17-941NF Seal Grip Alkyd Universal Primer.
         2) Sherwin-Williams Fast Dry Interior/Exterior Oil-Based Primer, Y24 Series
         3) Diamond Vogel Iron Prime 250 Fast Dry Primer
      b) Topcoat: Latex, exterior, semi-gloss.
         1) PPG Paints 6-900XI Speedhide Exterior Semi-Gloss.
         2) Sherwin-Williams DuraCraft Acrylic Latex Exterior, C14 Series
         3) Diamond Vogel PermAcryl Exterior 100% Acrylic Latex

3.9 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:
   1. Dry Environments:
      a. One (1) coat, latex block filler:
         1) PPG Paints; 6-7 Speedhide Interior/Exterior Masonry Latex Block Filler.
         2) Sherwin-Williams PrepRite Block Filler, B25W25
         3) Diamond Vogel DiaPro Acrylic Block Filler
      b. Two (2) coats, acrylic-latex enamel (eggshell):
         1) PPG Paints; 6-4310XI Speedhide Zero VOC Interior Latex Eggshell.
         2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Eg-Shel, B41 Series
         3) Diamond Vogel Zero Plus Interior Zero VOC* Latex
   2. Wet Environments:
      a. One (1) coat, epoxy block filler:
         1) PPG Paints; Amerlock Epoxy Block Filler 400 BF.
         2) Sherwin-Williams Kem Cat-Coat HS Epoxy Block Filler, B42W400
         3) Diamond Vogel Vers-E-Poxy 100 Waterborne Epoxy Block Filler
      b. Two (2) coats, epoxy finish (Wet Environments):
         1) PPG Paints; Amerlock Epoxy 400VOC.
         2) Sherwin-Williams Tank Clad HS Epoxy, B62 Series

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3) Diamond Vogel **Vers-E-Poxy 122 Water Reducible Polyamide Epoxy**

B. Gypsum Board Substrate:
3. Walls:
   a. One (1) coat, latex primer:
      1) PPG Paints; 6-2 Speedhide X-Green Interior Latex Sealer/Primer.
      2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28 Series
      3) Diamond Vogel **Pro Max Interior Latex Primer/Sealer**
   
   b. Two (2) coats, -acrylic-latex enamel (eggshell):
      1) PPG Paints; 6-4310XI Speedhide Zero VOC Interior Latex Eggshell.
      2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B41 Series
      3) Diamond Vogel **Zero Plus Interior Zero VOC* Latex**

4. Ceilings:
   a. One (1) coat, latex primer:
      1) PPG Paints; 6-2 Speedhide X-Green Interior Latex Sealer/Primer.
      2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28 Series
      3) Diamond Vogel **Pro Max Interior Latex Primer/Sealer**
   
   b. Two (2) coats, Acrylic-Latex (flat):
      1) PPG Paints; 12-110 Speedhide Pro EV Latex Wall & Ceiling Flat.
      2) Sherwin-Williams Property Solution Interior Latex Flat, B30 Series
      3) Diamond Vogel **Elevate Interior Latex Ultra Flat Ceiling Paint**

C. Steel Substrate:
5. Hollow Metal Doors and Frames:
   a. One (1) coat, water based primer:
      2) Sherwin-Williams DTM Acrylic Primer/Finish, B66 Series
      3) Diamond Vogel **Vers-Acryl 303 Acrylic DTM Primer/Finish**
   
   b. Two (2) coats, alkyd/acrylic eggshell enamel:
      1) PPG Paints; 6-1410 Speedhide Interior/Exterior WB Alkyd Satin.
      2) Sherwin-Williams ProMar 200 WB Acrylic-Alkyd Eg-Shel, B33 Series
      3) Diamond Vogel **SureFlo Acrylic Latex Enamel**

6. Galvanized-Metal Substrates & Ductwork:
   a. One (1) coat, water based primer:
      2) Sherwin-Williams DTM Acrylic Primer/Finish, B66 Series
      3) Diamond Vogel **Vers-Acryl 303 Acrylic DTM Primer/Finish**
   
   b. Two (2) coats, Water based enamel (satin):
      2) Sherwin-Williams Pro Industrial WB Epoxy Eg-Shel, B73 series
      3) Diamond Vogel **Vers-Acryl 303 Acrylic DTM Primer/Finish**

7. Overhead Metal Roof Decking – (Pre-Primed Steel):
   a. Two (2) coats, Water-Based Interior Dry Fog:
1) PPG Paints; 6-725XI Speedhide SuperTech WB Flat Dry Fog or 6-724XI Speedhide SuperTech WB Semi Dry Fog - self priming.
2) Sherwin-Williams
3) Diamond Vogel Luminance 300 Latex Dri-Mist Flat

8. Overhead Metal Roof Decking – (Galvanized):
   a. Two (2) coats, WaterBased Interior Dry Fog:
      1) PPG Paints; 6-725XI Speedhide SuperTech WB Flat Dry Fog or 6-724XI Speedhide SuperTech WB Semi Dry Fog - self priming.
      2) Sherwin-Williams Pro Industrial WB Acrylic Dryfall Flat, Eg-Shel, or Semi-Gloss, B42 Series
      3) Diamond Vogel Luminance 300 Latex Dri-Mist Flat

END OF SCHEDULE
SECTION 10 11 00
VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Markerboards (MB)
   2. Tackboard (TB)

1.2 SUBMITTALS

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

B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of panel joints.
   2. Include sections of typical trim members.

C. Samples: For each exposed product and for each color and texture specified.

D. Qualification Data: For qualified Installer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display surfaces to include in maintenance manuals.

B. Warranty(s) as specified elsewhere in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer’s authorized representative who is trained and approved for installation of sliding visual display units required for this Project.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.
1.6 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces exhibit crazing, cracking, or flaking.
   2. Warranty Period: 1 years from date of Substantial Completion for tackboards.

PART 2 - PRODUCTS

2.1 MATERIAL OPTIMIZATION

A. Products specified in this section have been identified to have a published Environmental Product Data (EPD) Declaration and/or and published Material Ingredient (HPD+). Project-wide requirements are described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.3 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: Porcelain-enamel-clad, ASTM A 463/A 463M, Type 1, stretcher-leveled aluminized steel, with 0.024-inch uncoated thickness; with porcelain-enamel coating fused to steel at approximately 1000 deg F.
   1. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Clarus.
      b. Egan Visual Inc.
      c. Polyvision
      d. Substitutions: Allowed in accordance with Section 00 26 00.

B. Natural Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.

C. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.4 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.015-inch-thick, porcelain-enamel face sheet with high-gloss finish.
   1. Basis of Design: Clarus, Surround Float Metal in sizes as noted on drawings.
   2. Particleboard Core: 3/8 inch thick; with 0.015-inch-thick, aluminum sheet backing.
   3. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.
2.5 **TACKBOARD ASSEMBLIES**

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Clarus.
   2. Egan Visual Inc.
   3. Wall talkers, Inc.

B. Natural-Cork Tackboard: 1/4-inch- thick, natural cork sheet factory laminated to 1/4-inch- thick hardboard backing.

2.6 **MARKERBOARD AND TACKBOARD ACCESSORIES**

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- thick, extruded aluminum; 5/8” trim on Markerboards and Tackboards.
   1. Factory-Applied Trim: Manufacturer's standard. See dimensions above.

B. Marker Tray: Manufacturers Standard.

2.7 **FABRICATION**

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.8 **ALUMINUM FINISHES**

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.9 **VISUAL DISPLAY SURFACE SCHEDULE**

A. Markerboard (MB):
   1. Markerboard: Porcelain-enamel markerboard assembly.
   2. Corners: Square.
   3. Width: See drawings
   4. Height: 4'-0" unless noted otherwise.
   5. Mounting: Wall.
   6. Mounting Height: Mount at 3'-0" a.f.f. unless noted otherwise in drawings
   8. Accessories:
B. Tackboard (TB):
   1. Tack Surface: Natural-cork tackboard assembly.
   2. Corners: Square.
   3. Width: As indicated on Drawings.
   4. Height: 4'-0" unless noted otherwise
   5. Mounting: Wall.
   6. Mounting Height: Mount at 3'-6" a.f.f. unless noted otherwise in drawings.
   7. Edges: Concealed by trim.

8. Locations:
   a. Report Room

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

B. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

C. Field-Assembled Visual Display Units: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.
   1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
   2. Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.

D. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.
   1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches o.c.
      a. Attach chalktrays to boards with fasteners at not more than 12 inches o.c.

E. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room. Cover and protect visual display surfaces.

END OF SECTION 10 11 00
SECTION 10 14 00
IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Interior Signage.

1.2 SUBMITTALS FOR REVIEW
A. Division 1 Section for Submittals: Procedures for submittals.
B. Shop Drawings: Indicate sign styles, lettering and locations, and overall dimensions of each sign.
   1. Owner to approve room numbering and locations prior to installation.
C. Samples:
   1. Two, illustrating full size sample sign, of each type specified, including method of attachment.
   2. Two sets, illustrating colors available for selection.

1.3 CLOSEOUT SUBMITTALS
A. Maintenance Data: For signs to include in maintenance manuals.
B. Warranty as specified elsewhere in this Section.

1.4 LEED SUBMITTALS
A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Package signs, labeled in name groups.
B. Enclose a copy of applicable installation instructions in each package.

1.6 WARRANTY
A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Deterioration of finishes beyond normal weathering.
   2. Deterioration of embedded graphic image.
   3. Separation or delamination of sheet materials and components.
B. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 AIR QUALITY
A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

### 2.2 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 Door Signs:
   a. Archetype Design.
   b. ASI Sign Systems, Inc.
   c. Signs Now
   d. Parker Signs.
   e. Substitutions: Allowed in accordance with Section 01600.

### 2.3 INTERIOR SIGNAGE

A. Room Number Signs:

1. Basis of Design: ASI InTac Eco ADA Ready:
   a. Size: 4” x 6”.
   b. Color and style: as selected by Architect from Manufacturer’s full range.
   c. Locations: Provide at ALL rooms except vestibules and bunk rooms.

B. Restroom Signs:

1. Basis of Design: ASI InTac Eco ADA Ready:
   a. Size: 8” x 8”
   b. Provide all graphics required to meet accessibility and building code requirements.

2. Location: Provide at all restrooms.

C. 2015 International Fire Code Required Signage per Appendix J “Building Information Sign”.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

#### 3.2 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Install signs in locations as directed by Architect and approved by local authority having jurisdiction.

C. Confirm room numbering with Owner.

D. Clean and polish.

E. Install sign units level, plumb, with sign surfaces free from distortion or other defects of appearance.

**END OF SECTION 10 14 00**
SECTION 10 14 19
DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Illuminated (halo effect), fabricated reverse-channel dimensional characters.
   2. Non-illuminated, fabricated solid-plate dimensional characters.
   3. Non-illuminated, solid-plate plaque signage with full-color custom graphic.

B. Related Sections: 01 81 13.14 Sustainable Design Requirements.
   1. Signage lighting to be in compliance with LEED requirements.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
   4. Show locations of electrical service connections.
   5. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

D. Delegated-Design Submittal: For signs indicated in "Performance Requirements" Article.
   1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Three (3) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Basis of Design Manufacturer: ASI Signage Innovations.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design sign structure and anchorage of dimensional letters or sign type(s) to withstand design loads per code.
C. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.  
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Electrical Components, Devices, and Accessories: UL-Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 ILLUMINATED, FABRICATED REVERSE-CHANNEL DIMENSIONAL CHARACTERS

A. Product: Series LF, Light Weight Fabricated Metal Dimensional Letters as manufactured by ASI Signage Innovations.

B. Letter/logo Material: Aluminum w/Painted Finish

C. Fabricated Letters:  
   1. Material: Aluminum w/Painted Finish. 
      a. Face material thickness: 0.125-inch thick. 
      b. Return material thickness: 0.090-inch thick. 
      c. Provide internal reinforcing to prevent bowing, twisting, oil-canning and other deformations.
   2. Height: as shown on drawings. 
   3. Depth: 3-4 inches, final depth to be determined by Architect. 
   4. Letter style: custom font to be selected by Architect, to generally match font shown on drawings. 
   5. 3/16” thick translucent polycarbonate backer. 
   6. Finishes: 
      a. Baked-Enamel or acrylic polyurethane wet-spray finish. 
      b. Color: Custom color as selected by Architect from manufacturer’s full range including premium and mica colors. 
      c. Overcoat: Manufacturer’s standard satin clear coating.

D. Mounting: Stainless steel projecting studs 

E. Illuminated Characters: Halo-effect illuminated character construction with LED lighting including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.
   1. Lighting: Dimmable, color-change Principal RGB LED modules with handheld remote controller. Lighting shall be full and even around entire letter, with no bright or dim spots, as observed from 15-feet away from signage. 
   2. Controls: 
      a. Provide interface to allow end-user (Owner) to control brightness and color of lighting. 
      b. Lighting to be in compliance with LEED requirements.

F. Power: Signage installer to coordinate power routing and requirements with electrical contractor. 
   1. Coordinate power supply with all associated contractors, including power supply routing through steel frame and cast stone masonry wall. Exposed power supply not acceptable. 
   2. Coordinate low-voltage transformer location with Architect prior to installation.
2.3 SOLID METAL PLATE FABRICATED DIMENSIONAL CHARACTERS

A. Product: Solid metal plate fabricated dimensional letters as manufactured by ASI Signage Innovations.

B. Letter/logo Material: Aluminum w/Painted Finish

C. Fabricated Letters:
   1. Height: as shown on drawings.
   3. Letter style: custom font to be selected by Architect, to generally match font shown on drawings.
   4. Finishes:
      a. Baked-Enamel or acrylic polyurethane wet-spray finish.
      b. Color: Custom color as selected by Architect from manufacturer’s full range including premium and mica colors.
      c. Overcoat: Manufacturer's standard satin clear coating.

D. Mounting: Stainless steel studs permanently adhered (epoxy or equal) into field-drilled holes. Back sides of letters to be flush with face of wall.

2.4 SOLID METAL PLATE PLAQUE SIGN WITH FULL-COLOR CUSTOM GRAPHIC

A. Product: Solid metal plate fabricated plaque sign as manufactured by ASI Signage Innovations.

B. Material: Aluminum with full-color custom graphic.

C. Plaque Sign:
   1. Size: as shown on drawings.
   3. Finishes:
      a. Baked-Enamel or acrylic polyurethane wet-spray finish.
      b. Graphic: Full-color custom graphic. High-resolution graphic to be furnished by Owner.
      c. Overcoat: Manufacturer's standard satin clear coating.

D. Mounting: Stainless steel studs permanently adhered (epoxy or equal) into field-drilled holes. Back sides of plaque sign to be flush with face of wall.

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
   3. Exposed Metal-Fastener Components, General:
      a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

   4. Sign Mounting Fasteners:
      a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

B. Adhesives: As recommended by sign manufacturer and that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
   3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   4. Internally brace signs for stability and for securing fasteners.
   5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
   6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examination:
   1. Site Verification of Conditions: Verify installation conditions previously established under other sections are acceptable for product installation in accordance with manufacturer's instructions.
   2. Scheduling of installation by Owner or it’s representative implies that substrate and conditions are prepared and ready for product installation. Proceeding with installation implies installer’s acceptance of substrate and conditions.

B. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
   1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
   3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
C. Mounting Methods:
1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
   a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

D. Installation:
1. Install product in accordance with supplier's instructions.
2. Install product in locations indicated using mounting methods recommended by sign manufacturer and free from distortion, warp, or defect adversely affecting appearance.
3. Install product level, plumb, and at heights indicated.
4. Install product at heights to conform to Americans with Disabilities Act Accessibility Guidelines (ADAAG) and applicable local amendments and regulations.
5. Install signs within the following tolerances and in accordance with manufacturer's recommendations:
   1. Interior Signs: Within 1/4 inch vertically and horizontally of intended location.
   2. Exterior Signs: Within 1 inch vertically and horizontally of intended location.
6. All signage wiring shall be concealed in wall and or ceiling cavities. Exposed raceways, either interior or exterior, will not be permitted. General contractor shall coordinate with associated trades.

E. Cleaning, Protection and Repair:
1. Repair scratches and other damage which might have occurred during installation. Replace components where repairs were made but are still visible to the unaided eye from a distance of 10 feet.
2. Remove temporary coverings and protection to adjacent work areas. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project in accordance with provisions in Division 1.

F. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 10 14 19
SECTION 10 14 24
EXTERIOR ALUMINUM CABINET SIGNAGE

1 GENERAL

1.1 SUMMARY

A. Related Documents: Provisions established within the General and Supplementary Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.
   1. 01 81 13.14 Sustainable Design Requirements: Signage lighting to be in compliance with LEED requirements.

B. Section Includes:
   1. Exterior aluminum cabinet sign, 1-sided, illuminated, monolith.

1.2 QUALITY ASSURANCE

A. Supplier: Obtain all products in this section from a single supplier.

B. Installer: Installation shall be performed by installer specialized and experienced in work similar to that required for this project.

C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design sign structure and anchorage of dimensional letters or sign type(s) to withstand design loads per code.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.3 SUBMITTALS

A. Submit in accordance with requirements of Division 1.

B. Product Data: Submit product data for specified products. Include material details for each sign specified. Include supplier’s installation instructions.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including dimensions, anchorage, wiring diagrams, and accessories.

D. Samples: Submit physical samples of the following:
   1. Exterior aluminum cabinet sign face physical color sample.
   2. Dimensional letter physical sample showing general assembly quality, color and finish.
      a) Note that the dimensions letters are very big; the sample does not need to be of an entire letter, but can be an approximate 12"x12" sample showing edge condition.
1.4 CLOSEOUT SUBMITTALS:

A. Submit operation and maintenance data for installed products, including precautions against harmful cleaning materials and methods.

B. Submit warranty documents specified herein.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Division 1.
   1. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
   2. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   3. Store products protected from weather, temperature, and other harmful conditions as recommended by supplier.
   4. Handle products in accordance with manufacturer's instructions.

1.6 WARRANTY

A. Project Warranty: Comply with requirements of Division 1.

B. Manufacturer's Warranty: Submit manufacturer's standard warranty document executed by authorized company official.
   1. Warranty Period: Three years from date of Substantial Completion.

2 PRODUCTS

2.1 SIGNAGE SYSTEMS

A. Basis of Design Manufacturer:
   1. ASI Sign Systems, Inc.
   2. Substitutions: Allowed in accordance with Section 00 26 00.

B. Exterior Aluminum Cabinet Sign:
   2. General:
      a) Construction: Provide 0.125-inch aluminum face bonded to a rigid 6061-T6 extruded aluminum framework. Sign shall have internal reinforcement to prevent surface deflection or oil-canning.
      b) Cabinet thickness: 4-5 inches. Final depth to be determined by Architect.
      c) Assembly: Sign assembly shall be as seamless and monolithic as possible. Provide concealed fastening as much as possible; where not possible, utilize color-match countersunk screws.
      d) Sign Finish: Provide satin matte polyurethane coating, with maximum glass of 15 degrees. Faces shall be smooth, free of scratches, blemishes or other imperfections.
      e) Color: Custom color to match metallic-coated sheet steel color 2 as specified in section 076200-2.1-C.
      f) End Detail: Square.
      g) Acrylic or Polycarbonate backing:
         1) Thickness: 0.187-inch thick.
         2) UV-stable.
4) Attachment: firmly attach backing material to sign face to prevent water intrusion into sign cabinet.

h) Illumination:
1) Source: Internally-lit, UL listed.
2) Illumination Type: Dimmable, color-change Principal RGB LED modules with handheld remote controller. Lighting shall be full and even around entire letter, with no bright or dim spots, as observed from 15-feet away from signage.
3) Internal lighting shall be designed and installed by sign supplier to provide fully even lighting.
4) Controls: Provide interface to allow end-user (Owner) to control brightness and color of lighting.
5) Coordinate power supply with all associated contractors, including casting power supply into cast-in-place concrete wall. Exposed power supply not acceptable.
6) Coordinate low-voltage transformer location with Architect prior to installation.
7) Lighting must be in compliance with LEED requirements.

3. Framework:
   a) Construction: Provide mitered and welded aluminum extrusion, reinforced with aluminum plate.
   b) Mounting: mount on cast-in-place concrete wall as shown on drawings.

4. Graphics:
   a) Fabrication: Graphics on aluminum face material shall be CNC router cut with 0.125-inch acrylic or polycarbonate backing.
   b) Perforations: Perforation pattern shall be fully custom as designed by the Architect. Architect will furnish sign fabricator with CAD file for preparation of shop drawings and fabrication of sign face.

5. Acceptable Materials: Use only non-rusting, non-degrading, compatible materials to fabricate sign and graphics. Steel, wood or plastic components are not acceptable.

2.2 FABRICATION - GENERAL

A. General: Comply with requirements indicated for materials, thickness, finishes, colors, designs, shapes, sizes, and details of construction.

B. Allow for thermal movement resulting from a maximum ambient temperature change (range) of 100 deg F (38 deg C). Design, fabricate, and install sign assemblies to prevent buckling, opening up of joints, and over-stressing of welds and fasteners.

C. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.

D. Pre-assemble signs in the shop to the greatest extent possible to minimize field assembly. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in a location not exposed to view after final assembly.

E. Conceal fasteners if possible; otherwise, locate fasteners to appear inconspicuous.
F. Form panels to required size and shape. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.

G. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.

H. Increase material thickness or reinforce with concealed stiffeners or backing materials as required to produce surfaces without distortion, buckles, warp, or other surface deformations.

2.3 NON-ILLUMINATED, FABRICATED REVERSE-CHANNEL DIMENSION CHARACTERS (MOUNTED TO FACE OF CABINET SIGN)

A. Product: Series LF, Light Weight Fabricated Metal Dimensional Letters as manufactured by ASI Signage Innovations.

B. Letter/logo Material: Aluminum w/Painted Finish

C. Fabricated Letters:
   1. Material: Aluminum w/Painted Finish.
      a. Face material thickness: 0.125-inch thick.
      b. Return material thickness: 0.090-inch thick.
      c. Provide internal reinforcing to prevent bowing, twisting, oil-canning and other deformations.
   2. Height: as shown on drawings.
   3. Depth: 3-4 inches, final depth to be determined by Architect.
   4. Letter style: custom font to be selected by Architect, to generally match font shown on drawings.
   5. Finishes:
      a. Baked-Enamel or acrylic polyurethane wet-spray finish.
      b. Color: Custom color as selected by Architect from manufacturer’s full range including premium and mica colors.
      c. Overcoat: Manufacturer’s standard satin clear coating.
   6. Mounting:
      a. Type: Projecting studs.
      b. Provide stud gauge, quantity and spacing to support letters. Provide adequate backing/support in aluminum sign cabinet for letter character mounting.
      c. Stud depth: 1-inch minimum; final stud depth to be determined by Architect.

3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify installation conditions previously established under other sections are acceptable for product installation in accordance with manufacturer’s instructions.

B. Scheduling of installation by Owner or it’s representative implies that substrate and conditions are prepared and ready for product installation. Proceeding with installation implies installer’s acceptance of substrate and conditions.
3.2 INSTALLATION

A. Install product in accordance with supplier’s instructions.

B. Install product in locations indicated using mounting methods recommended by sign manufacturer and free from distortion, warp, or defect adversely affecting appearance.

C. Install product level, plumb, and at heights indicated.

D. Field verify height and width of cast-in-place concrete wall and match width of wall.

3.3 CLEANING, PROTECTION, AND REPAIR

A. Repair scratches and other damage which might have occurred during installation. Replace components where repairs were made but are still visible to the unaided eye from a distance of 10 feet.

B. Remove temporary coverings and protection to adjacent work areas. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project in accordance with provisions in Division 1.

3.4 SIGN SCHEDULE

A. Schedule: Refer to signage schedule and Drawings for sizes, locations, and layout of signage types, sign text copy, and graphics.

END OF SECTION 10 43 20
PART 1 - GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Section 09 29 00 - Gypsum board assemblies

B. This Section includes the following:

1.2 SUBMITTALS

A. General: Submit the following in accordance with conditions of contract and Division 1 specification section 01 33 00.

B. Product Data: Submit physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Manufacturer's Installation Instructions: Submit procedures, and perimeter conditions requiring special attention.

D. Product data and detailed specifications for each system component and installation accessory required, including installation methods for each type of substrate.

E. Shop drawings showing locations, extent and installation details of corner guards. Show methods of attachment to adjoining construction.

F. Samples for verification purposes: Submit the following samples, as proposed for this work, for verification of guard.
   1. Submit 12" long sample of each model specified.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 "Sustainable Design Requirements".

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
   1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Corner Guard: Provide no fewer than two, 8-foot- (2.4-m-) long units.

C. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect materials from physical damage and from deterioration by 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. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.

C. Store materials in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elements. A minimum room temperature of 40°F (4°C) and a maximum of 100°F (38°C) should be maintained.

D. Material must be stored flat.

1.6 QUALITY ASSURANCE

A. Installer qualifications: Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.

B. Manufacturer’s qualifications: Not less than 5 years experience in the production of specified products and a record of successful in-service performance.

C. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.7 PROJECT CONDITIONS

A. Materials must be acclimated in an environment of 65° - 75°F (18° - 24°C) for at least 24 hours prior to beginning the installation.

B. Installation areas must be enclosed and weatherproofed before installation commences.

1.8 COORDINATION

A. Coordinate Work with wall or partition sections for installation of concealed blocking or anchor devices. Coordinate with contractor providing wall blocking, to ensure that blocking is provided in all areas that require corner guards.

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 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:
   A. Basis of Design: Koroguard
   B. Substitutions: Allowed in accordance with Section 00 26 00.
2.3 CORNER GUARD

A. Stainless Steel 90 degree corner guard.

B. Basis of Design: C/S Acrovyn CO-8 Stainless Steel, 90 degree with 3-1/2” legs.
   1. Finish: 304 Stainless alloy #4 satin finish.
   2. Location: At all gypsum board outside corners.
   3. Height: Full height, start above 4” base.

2.4 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

C. Form end trim closure by capping and finishing smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer’s instructions.

B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer’s installation instructions.

3.3 INSTALLATION

A. Install the work of this section in strict accordance with the manufacturer’s recommendations, using only approved mounting hardware, and locating all components firmly into position, level and plumb.

B. Temperature at the time of installation must be between 65°- 75°F (18°- 24°C) and be maintained for at least 48 hours after the installation.

3.4 CLEANING

A. General: Immediately upon completion of installation, clean guards in accordance with manufacturer’s recommended cleaning method.

B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.5 PROTECTION

A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.
SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Public-use washroom accessories.
   2. Public-use shower room accessories.
   3. Private-use bathroom accessories.
   4. Underlavatory guards.
   5. Custodial accessories.

1.2 SUBMITTALS

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

B. Product Schedule:
   1. Identify locations using room designations indicated on Drawings.
   2. Identify products using designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

B. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

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. A & J Washroom Accessories, Inc.
   2. American Dryer, Inc.
   3. American Specialties, Inc.
   5. Bradley Corporation.
   6. Columbia Partitions, Inc., a Division of PSiSC.
   8. Plumberex Specialty Products, Inc.
   9. TCI Products.
   10. Truebro, Inc.

B. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. Bobrick Washroom Equipment, Inc.
   2. Excel Dryers
3. Foundations.
4. Koala Child Care Products
5. Kennedy Hygiene Co.

C. Grab Bar TBA-1
   1. Basis-of-Design Product: B-6806
   3. Material: Stainless steel, 0.05 inch thick.
      a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.
   5. Configuration and Length: As indicated on Drawings and according to ADA guidelines.

D. Sanitary-Napkin Disposal Unit TBA-2
   1. Basis-of-Design Product: B-270
   3. Door or Cover: Self-closing disposal-opening cover.
   5. Material and Finish: Stainless steel, No. 4 finish (satin).

E. Toilet Tissue (Roll) Dispenser TBA-3
   1. Basis-of-Design Product: B-686
   2. Description: Double-roll dispenser.
   5. Capacity: Designed for 5-inch-diameter tissue rolls.

F. Mirror Unit TBA-4
   1. Basis-of-Design Product: B-290 series
   2. Frame: Stainless-steel angle, 0.05 inch thick.
      a. Corners: Welded and ground smooth.
      a. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
      b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
   4. Size: As indicated on Drawings.

G. Liquid-Soap Dispenser TBA2
   1. Basis-of-Design Product: B-4112
   2. Description: Designed for dispensing soap in liquid or lotion form.
   5. Materials: Satin stainless steel
   6. Lockset: Locked hinge lid w/ special key, Vandal resistant
   7. Refill Indicator: Window type.

H. Combination Towel (Folded) Dispenser/Waste Receptacle TBA-6
   1. Basis-of-Design Product: B-3942
   2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.

4. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.


7. Liner: Reusable, vinyl waste-receptacle liner.

8. Lockset: Tumbler type for towel-dispenser compartment.

I. Robe Hook TBA-7
1. Basis-of-Design Product: Bobrick B-682
2. Description: Double-prong unit.

J. Soap Dish TBA-8
1. Basis-of-Design ProductB-4380
2. Description: Without washcloth bar.

K. Utility Shelf with Mop and Broom Holder and Rag Hooks TBA-9
1. Basis-of-Design Product: Bobrick B-239
2. Description: With exposed edges turned down not less than 1/2 inch and supported by two triangular brackets welded to shelf underside.
3. 6” H, 8” D, 36”: Long.
4. Rag Hooks: (3)
5. Anti-Slip Mop Holders: (4)
6. Material and Finish: Not less than nominal 0.05-inch- thick stainless steel, No. 4 finish (satin).

L. Shower Seat TBA-10
1. Basis-of-Design Product: Bobrick B-5181
2. Configuration: L-shaped seat, designed for wheelchair access.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
5. Dimensions: 33” wide by 22 5/16” deep.

M. Shower Curtain and Rod TBA-11
1. Rod Basis-of-Design Product: Bobrick B-6107
   a. Description: 1-inch OD; fabricated from nominal 0.0375-inch- thick stainless steel.
   b. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
   c. Finish: No. 4 (satin).
2. Curtain Basis-of-Design Product:
   a. Provided and installed by owner.

N. Drying Hook TBA-12
1. Basis-of-Design Product: Bobrick B-677 Towel Pin
2. Description: Bright Polish Stainless steel. Projects 3 3/8” from wall.

O. Mop Hook TBA – 13
1. Basis-of-Design Product: Bobrick B-223x24 Mop and broom holder
2. Description: Anti-slip mop holders have spring-loaded rubber cam that grips handles 7/8” to 1 1/4” (20-30mm) diameter. Holds 3 mops 3 1/4” (85mm) from wall. Height 5” (125mm).
3. Finish: Type 304 stainless steel, satin finish.

P. Paper Towel Dispenser TBA-14
2. Description: Durable plastic construction; translucent cover. "touch-free" pull towel mechanism dispenses 12" (305mm) length per pull [1/8 lbs (8.0 N)] of universal towels. Accommodates 8" (205mm) wide, up to 8" (205mm) diameter rolls, 800 ft (244m) long, plus 3 1/2" (90mm) diameter stub roll with automatic transfer. Locking cabinet with removable and permanent keys.

Q. Underlavatory Guard: Provide at all locations with exposed pipes.
1. Basis-of-Design Product: Truebro, Inc. LavGuard2
2. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.

2.2 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of 4 keys to Owner’s representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers’ written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer’s written instructions.

END OF SECTION 10 28 00
SECTION 10 44 00
EMERGENCY ACCESS CABINETS

PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes fire department access cabinets.

1.2 SUBMITTALS
   A. Product Data: For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS
   A. Maintenance data.

1.4 QUALITY ASSURANCE
   A. Coordinate sizes and locations of fire department access cabinets with jurisdiction having authority.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN MANUFACTURER

   B. Size, location, and type, and number of cabinets: as required by jurisdiction having authority.
      1. Recessed cabinets are recommended for new masonry or concrete construction.

   C. Options: Tamper switch.

   D. Finish: as selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Install in accordance with jurisdiction having authority and manufacturer’s direction.

END OF SECTION 10 44 00
SECTION 10 44 13
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes fire protection cabinets for fire extinguishers.

1.2 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
C. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS
A. Maintenance data.

1.4 QUALITY ASSURANCE
A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
B. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINETS
A. Cabinet Type: Suitable for fire extinguisher.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Basis of Design Manufacturer: J. L. Industries, Inc., a division of Activar Construction Products Group
      b. End & Croker Corporation
      c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc
      d. Larsen's Manufacturing Company
      e. Modern Metal Products, Division of Technico Inc.
      f. Moon-American
      g. Potter Roemer LLC
      h. Watrous Division, American Specialties, Inc.

B. Recessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of sufficient depth to accommodate recessed cabinet installation.
   1. Cabinet Style: Cosmopolitan Stainless Steel Fire Extinguisher Cabinet.
   2. Square-Edge Trim: 3/8-inch flat trim.
   3. Cabinet Material: Steel, painted white epoxy.
4. Door and Trim Material:
   a. Finish: #4 brushed stainless steel.
   b. Door Style: Vertical duo with pull handle.
   c. Door Glazing: Tempered glass (clear).
   d. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

C. Accessories:
   1. Door latch: Roller latch to secure door in closed position while allowing for easy opening of door.
   2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
      a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
         1) Location: Applied to cabinet door.
         2) Application Process: Decals.
         3) Lettering Color: Red.
         4) Orientation: Vertical.

D. Fire-Rated Cabinets:
   1. Provide fire-rated cabinets where installed in fire-rated wall assemblies to match criteria listed above.

2.2 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Miter and weld joints and grind smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed and prepare recesses as required by type and size of cabinet and trim style.

B. Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

C. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

D. Identification: Apply decals at locations indicated.

E. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

F. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13
SECTION 10 44 16
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 SUBMITTALS
A. Product Data: For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS
A. Operation and maintenance data.
B. Warranty as specified elsewhere in this Section.

1.4 QUALITY ASSURANCE
A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.5 WARRANTY
A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS
A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Amerex Corporation.
      b. Ansul Incorporated; Tyco International Ltd.
      c. Badger Fire Protection; a Kidde company.
      d. Buckeye Fire Equipment Company.
e. Fire End & Croker Corporation.
g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
h. Larsen's Manufacturing Company.
i. Moon-American.
j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
k. Potter Roemer LLC.
l. Pyro-Chem; Tyco Safety Products.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

A. Multipurpose Dry-Chemical Type:
1. Class A Hazard: 2-A:10-B:C nominal capacity, with dry chemical in manufacturer's standard enameled container.
   a. Provide at all locations, unless noted otherwise.

2.2 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Amerex Corporation.
   b. Ansul Incorporated; Tyco International Ltd.
   c. Badger Fire Protection; a Kidde company.
   d. Buckeye Fire Equipment Company.
   e. Fire End & Croker Corporation.
   g. Larsen's Manufacturing Company.
   h. Potter Roemer LLC.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16
SECTION 10 50 10
LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Solid-plastic, polymer resin lockers
   2. Heavy-duty metal lockers
   3. Locker benches

1.2 SUBMITTALS

A. Product Data: For each type of locker indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.
   1. Show locker fillers, trim, base, sloping tops, and accessories. Include locker-numbering sequence.

C. Samples: For each exposed finish and for each color and texture required. Submit manufacturer’s full range of colors for selection by Architect.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Provide twenty five (25) year warranty for manufacturing defects in workmanship of material, against breakage or delaminating.

PART 2 - PRODUCTS

2.1 SOURCING

A. Products specified in this section contribute to the project-wide sourcing requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.2 RECYCLED CONTENT

A. Products specified in this section contribute to the project-wide requirements for Recycled Content described in Section 08 13.14 “Sustainable Design Requirements”.

2.3 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

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2.4 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Basis of Design: Bradley; Lenox Locker “Gear Locker” Solid Plastic
   2. Scranton Products; Tufftec 2.0
   3. Substitutions: Allowed in accordance with Section 00 26 00.

2.5 SOLID PLASTIC LOCKER (L-1)

A. Lockers shall be solid plastic manufactured by Lenox Locker, Inc., P.O. Box 317, Dunmore, Pennsylvania 18512.
   1. Width: 24 inches.
   2. Depth: 24 inches
   3. Height: 72 inches.
   5. Mounting: Surface mounted.
   7. Bench/Drawer Height: 18”.
   8. Slope top
   10. Ventilation Method: Louvered top and bottom frame and top and bottom of door.
   11. Class: conventional with integral bench; see plans and elevations
   12. Number Plates: Provide rectangular shade aluminum plates. Form numbers of block font style with ADA designation, in contrasting color.
   13. 5% of Lockers to be fully ADA compliant. See drawings for locations.

2.6 METAL LOCKER (L-2)

A. Basis of Design: Core Athletic by Debourgh
   1. Width: 18 inches.
   2. Depth: 18 inches
   3. Height: 72 inches.
   5. Mounting: Surface mounted.
   6. Base: CMU, see drawings
   7. Slope top
   9. Ventilation Method:
      a. Door: Louvered
      b. Sides: Solid
   10. Number Plates: Provide rectangular shade aluminum plates. Form numbers of block font style with ADA designation, in contrasting color.
   11. 5% of Lockers to be fully ADA compliant. See drawings for locations.

B. Materials
   1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
   2. Steel Tube: ASTM A 500, cold rolled.
   3. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
2.7 SOLID PLASTIC Locker CONSTRUCTION

A. Sides, shelves, tops, and bottoms shall be made from polymer resin formed under high pressure to solid plastic components 3/8 inches thick with a homogenous color.

B. Doors shall be constructed from polymer resin formed under high pressure to a solid plastic component 1/2 inch thickness with horizontal venting at the top & bottom of each locker.

C. Door frames shall be constructed from polymer resins formed under high pressure to a solid plastic component 1/2 inch thick with a homogenous color.

D. Material testing: All solid plastic components shall resist deterioration and discoloration when subjected to the following chemicals:
   1. Bleach 12% Chlorine water Trisodium Phosphate
   2. Ammonia liquid Hydraulic acid Vinegar
   3. Caustic Soda Soaps

E. Continuous latch shall provide a finger-slide latching mechanism that is capable of accepting a padlock and is securely fastened to the door. Latch mechanism shall be attached to the entire length of the door, providing a continuous security latch.

F. Door hinge shall be continuous and integrate into the full length of the door and main locker body, made entirely from plastic without any steel or metal parts.

G. Coat hooks shall be made from solid plastic and attached with interlocking dovetails. Provide two per opening.

H. Finish shall be commercial grade smooth for tops, bottoms, side walls, shelves, and frames, in the color white. Doors shall have slightly textured finish to reduce marring and be from the manufacturer's standard colors.

2.8 METAL Locker CONSTRUCTION

A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
   1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
   2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for nominal assembly at Project site.

D. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.

E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
F. Coat Rods: Fabricated from 1-inch-diameter steel; powder coat finish.

G. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

H. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

2.9 WALL MOUNTED BENCHES

A. Provide bench units with overall assembly height of 17-1/2 inches.

B. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.
   1. Size: See drawings
   2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.

C. Wall mounted bracket:
   1. Basis of Design: Federal Brace, Georgian Wall Bench Bracket

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install lockers plumb and square.

C. Anchor lockers to base framing and walls at intervals recommended by manufacturer, but not more than 36 inches o.c. Install anchors through backup reinforcing plates where necessary to avoid distortion, using concealed fasteners.

D. Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

E. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

F. All-Welded Metal Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.

G. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
   1. Attach hooks with at least two fasteners.
      a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

H. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor. END OF SECTION 10 50 10
SECTION 10 51 13
TURNOUT GEAR LOCKERS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Heavy-duty metal lockers for turnout gear.

1.2 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Shop Drawings: For metal lockers. Include plans, elevations, sections, details, and attachments to other work.
C. Samples: For units with factory-applied color finishes.

1.3 LEED SUBMITTALS
A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 CLOSEOUT SUBMITTALS
A. Maintenance data.
B. Warranty as specified elsewhere in this Section.

1.5 QUALITY ASSURANCE
A. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board’s “Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities”.
B. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver and Install after all other trades such as painting have been completed.

1.7 WARRANTY
A. Warranty: Provide manufacturer’s standard warranty.

PART 2 - PRODUCTS

2.1 AIR QUALITY
A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

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2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

B. Steel Tube: ASTM A 500, cold rolled.

C. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

D. Anchors: Material, type, and size required for secure anchorage to each substrate.
   1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
   2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.3 TURNOUT GEAR LOCKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:

B. Locker Size and Arrangement:
   1. Size: 24" wide x 22" deep x 74.5" tall.

C. Outer Frames: ASTM A513 steel tubing, 1.25-inch O.D. by gage, 0.06 wall thickness.

D. Inner Grid: A ASTM A510 cold drawn steel wire, 0.25-inch diameter resistance welded to a 3 inch square pattern. Steel surface finish to allow application of durable powder coated finish.

E. Meshback Panel: ASTM A510 cold drawn steel wire, 0.25-inch diameter resistance welded to a 3 inch square pattern.

F. Top and Bottom Shelves: ASTM A510 cold drawn steel wire, 0.25-inch diameter resistance welded with cold-formed bends. Provide 20 gate 0.036-inch steel bracket on top shelf for mounting of name placards.

G. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:
   1. Single-Tier Units: Three hooks, two adjustable shelves

H. Accessories:
   1. Hooks: Cold formed wire resistance welded into a quick-detachable unit. Provide three hooks for each individual system opening.
   2. Coat Drying Hanger: Cold formed wire resistance welded into a quick-detachable unit. Provide one hanger for each individual system openings.
   3. Gove Drying Hanger: Cold formed wire resistance welded into a quick-detachable unit. Provide one hanger for each individual system opening.
   4. Horizontal Hanging Rod: Manufacturer’s standard stainless steel removable rod attached with cold formed wire.

I. Finish: Powder coat.
   1. Color(s): As selected by Architect from manufacturer's full range.
J. Quantities and Locations: See Drawings for quantities and locations.

2.4 FABRICATION

A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
   1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
   2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for nominal assembly at Project site.

D. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.

E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

F. Coat Rods: Fabricated from 1-inch-diameter steel; powder coat finish.

G. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

H. Continuous Base: Formed into channel or zee profile for stiffness and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.

2.5 STEEL SHEET FINISHES

A. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.
   1. Anchor locker runs at ends and at intervals recommended by manufacturer. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
   2. Anchor single rows of metal lockers to walls near top and bottom of lockers.

B. All-Welded Metal Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.
C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
   1. Attach hooks with at least two fasteners.
      a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

D. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

END OF SECTION 10 51 13
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes ground-mounted aluminum flagpoles.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to the following design criteria:
   2. Wind Loads: Basis Wind Speed of 110 mph.
   3. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: Show general layout, jointing, grounding method, and anchoring/support systems.
C. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.4 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain flagpole as a complete unit from a single manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. General: Spiral wrap flagpole with heavy kraft paper or other weathertight wrapping and enclosed in hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 RECYCLED CONTENT

A. Products specified in this section contribute to the project-wide requirements for Recycled Content described in Section 0 81 13.14 "Sustainable Design Requirements".

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Flagpole; a Kearney-National Inc. company.
2. Baartol Company.
3. Concord Industries, Inc.

### 2.3 FLAGPOLES

**A.** Exposed Height: 28 feet.


**C.** Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, not less than 0.064-inch nominal wall thickness. Provide with 3/16-inch steel bottom plate and support plate; 3/4-inch diameter, steel ground spike; and steel centering wedges welded together. Galvanize steel after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole. Provide flashing collar of same material and finish as flagpole.

**D.** Cast-Metal Shoe Base: For anchor-bolt mounting; provide with anchor bolts.

**E.** Finial Ball: Manufacturer's standard flush-seam ball, sized to match flagpole-butt diameter. Fabricate from 0.063-inch spun aluminum, finished to match flagpole.

**F.** Internal Halyard, Cam Cleat System: 5/16" Ø braided polypropylene halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door with compression seal secured with cylinder lock. Finish truck assembly to match flagpole.

**G.** Halyard Flag Snaps: Provide two bronze swivel snap hooks per halyard.
   1. Provide with neoprene or vinyl covers.

**H.** Floor panel inside flush access door is not allowed.

### 2.4 MISCELLANEOUS MATERIALS

**A.** Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

**B.** Sand: ASTM C 33, fine aggregate.

**C.** Elastomeric Joint Sealant: Joint sealant complying with requirements in Division 07 Section "Joint Sealants."

### 2.5 ALUMINUM FINISHES

**A.** Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
   1. Color: As selected by Architect from full range of industry colors and color densities.

**B.** Plate and Finish: Ferrous metal and bronze components to match pole.

**C.** Exterior Surface: Smooth and uninterrupted with uniform taper.
PART 3 - EXECUTION

3.1 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.

B. Ground Set: Place foundation tube, center, and brace to prevent displacement during concreting. Install flagpole, plumb, in foundation tube. Place tube seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

C. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

D. Mounting Brackets and Bases: Anchor brackets and bases securely through to structural support with fasteners as indicated on Shop Drawings.

END OF SECTION 10 75 00
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes roller shades.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Window Treatment Schedule: Use same designations indicated on Drawings.
   2. Shade Fabric Product Data.

B. Shop Drawings: Include plans, elevations, sections, details, details of installation, operational clearances, and relationship to adjoining Work.
   1. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
   2. Coordination Drawings: Drawn to scale and coordinating penetrations and ceiling-mounted items.

C. Samples: For each exposed finish and for each color and texture required.

1.3 LEED SUBMITTALS

A. Provide EPD, HPD+, Sourcing, and Low Emitting Materials data as applicable for products used. See Section 01 81 13.14 “Sustainable Design Requirements”.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Fire-Test-Response Characteristics: Provide products passing flame-resistance testing according to NFPA 701 by a testing agency acceptable to authorities having jurisdiction.

C. Comply with WCMA A 100.1.

PART 2 - PRODUCTS

2.1 AIR QUALITY

A. Products required to meet Low Emitting Materials requirements as described in Section 01 81 13.14 “Sustainable Design Requirements”.

SVPA No. 18079
Des Moines Fire Station #11
Activity ID 10-2019-001
Des Moines, IA
2.2 MATERIAL OPTIMIZATION

A. Products specified in this section have been identified to have a published Environmental Product Data (EPD) Declaration and/or and published Material Ingredient (HPD+). Project-wide requirements are described in Section 01 81 13.14 “Sustainable Design Requirements”.

2.3 ROLLER SHADES

A. Products: Subject to compliance with requirements, provide one of the following:
1. SWF Contract.
2. MechoShade Systems, Inc.
3. Substitutions: Allowed in accordance with Section 00 26 00.

1. Type A: Single Roll
   a. Openness Factor 3%
2. Type B: Dual Roll
   a. Openness Factor 3% and black out
3. Type C: Single Roll
   a. Openness: Black out

C. Shade Band Material: PVC-coated fiberglass
1. Colors: As selected by Architect from manufacturer's full range

D. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets. Provide capacity for one roller shade band(s) per roller.

E. Direction of Roll: Regular, from back of roller.

F. Mounting Brackets: Galvanized or zinc-plated steel.

G. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; removable design for access.

H. Top/Back Cover: L-shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.

I. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide concealed, by pocket of shade material, internal-type.

J. Mounting: Attached to window header.

K. Shade Operation: Manual; with cordless system lift operator.
2.4 ROLLER SHADE FABRICATION

A. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.

2. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

B. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting roller, and operating hardware and for hardware position and shade mounting method indicated.

C. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

PART 3 - EXECUTION

3.1 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades. Refer to Division 01 Section Demonstration and Training.

END OF SECTION 12 24 13

ROLLER SHADE SCHEDULE IMMEDIATELY FOLLOWS
**Roller Shade Schedule**

<table>
<thead>
<tr>
<th>Room Name/Number</th>
<th>Window Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff Lockers 119</td>
<td>A</td>
<td>See drawings for all quantities</td>
</tr>
<tr>
<td>Staff Lockers 120</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Staff Lockers 121</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Report Room 106</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Training Room 103</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Kitchen Dining 110</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Day Room 111</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Bunk Room 119A</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Bunk Room 119B</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Bunk Room 119C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Captains Bunk 122 A</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Lieutenant Bunk 122B</td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>

END OF SCHEDULE
SECTION 21 05 00
BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 21 Sections. Also refer to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.

B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make his portion of the Mechanical Work a finished and working system.

C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

D. Scope of Work:

1. **Plumbing Work** shall include, but is not necessarily limited to:

   a. Furnish and install all items listed in the Plumbing Material List.

   b. Furnish and install a new domestic water service to the building.

   c. Furnish and install water meters and domestic water backflow preventers as required by Code.

   d. Furnish and install a complete domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.

   e. Furnish and install gas piping system including all meter requirements.

   f. Furnish and install water heaters.

   g. Furnish and install a new fire protection service to the building including backflow preventer as required by Code.

   h. Furnish and install a complete storm water drainage system.

   i. Furnish and install condensate drain piping from plumbing related equipment such as ice machines.

   j. Furnish and install a complete sanitary sewer and vent system.
k. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.

2. **Air Conditioning and Ventilating Work** shall include, but is not necessarily limited to:
   a. Furnish and install package indoor air handling units complete with dampers, filters, coils, fans, and motors.
   b. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
   c. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
   d. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
   e. Furnish and install mechanical room ventilation systems including louvers, ductwork, insulation, and fans.
   f. Furnish and install gas flues, stacks, and breechings.
   g. Furnish and install all temperature control systems.
   h. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
   i. Furnish and install refrigerant piping, accessories, and final charge of refrigerant.
   j. Furnish and install condensate drain piping from cooling related equipment such as air handlers and cooling coil drain pans.

3. **Temperature Control Work** shall include, but is not necessarily limited to:
   a. Furnish and install a complete temperature control system as specified in Section 23 09 00.
   b. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.
   c. Furnish automatic control valves and dampers for installation by others.
   d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.

4. **Fire Protection Work** shall include, but is not necessarily limited to:
   a. Furnish and install a complete wet pipe sprinkler system for areas noted on the drawings.
   b. Furnish and install all items listed on the Fire Protection Material List.
   c. Furnish all hydraulic calculations and working sprinkler drawings.
d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

5. **Testing, Adjusting, and Balancing Work** shall include, but is not necessarily limited to:
   a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, plumbing systems, and verification of control systems.

### 1.3 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

#### A. Definitions:

1. "Mechanical Contractors" refers to the following:
   a. Plumbing Contractor.
   b. Air Conditioning and Ventilating Contractor.
   c. Temperature Control Contractor.
   d. Fire Protection Contractor.
   e. Testing, Adjusting, and Balancing Contractor.

2. **Motor Control Wiring**: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.

3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.

4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.

5. **Temperature Control Wiring**: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.
   a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

6. **Control Motor**: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
October 15, 2019

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.

2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.

3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.

4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.

5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:
   a. Light fixtures.
   b. Gravity flow piping, including condensate.
   c. Electrical busduct.
   d. Sheet metal.
   e. Electrical cable trays, including access space.
   f. Sprinkler piping and other piping.
   g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:
   a. Makeup Air Units.
   b. Gas Trains.
   c. Package Air Handling Units.

2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.

3. Temperature Control Contractor's Responsibility:
   a. Wiring of all devices needed to make the Temperature Control System functional.
b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor.

c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.

2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.

3. Provides motor control and temperature control wiring, where so noted on the drawings.

4. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.

5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing, piping, and any item that may impact coordination with other disciplines.

b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5” and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5” and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
d. Maintenance clearances and code-required dedicated space shall be included.

e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.

2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

   a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor’s use if the contractor signs and returns an “Electronic File Transfer” waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

   a. Scale of drawings:

      1.) General plans: 1/4 Inch = 1'-0" (minimum).

      2.) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).

      3.) Risers: 1/2 Inch = 1'-0" (minimum).

      4.) Mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).

      5.) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.

2. A plotted set of coordination drawings shall be available at the project site.

3. Coordination drawings are not shop drawings and shall not be submitted as such.

4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.

5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.

6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.

7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.

8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.

9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.
   a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
   b. Potential layout changes shall be made to avoid additional access panels.
   c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
   d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
   e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.

12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

### 1.5 QUALITY ASSURANCE

**A. Contractor’s Responsibility Prior to Submitting Pricing Data:**

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.

2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor’s own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor’s risk.

**B. Qualifications:**

1. Only products of reputable manufacturers are acceptable.

2. All Contractors and subcontractors shall employ only workers skilled in their trades.

**C. Compliance with Codes, Laws, Ordinances:**

1. Conform to all requirements of the City of Des Moines, Iowa’s Codes, Laws, Ordinances and other regulations having jurisdiction.

2. Conform to all State Codes.

3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.

4. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.

5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.

7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.

2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.

3. Pay all charges for permits or licenses.

4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.

5. Pay all charges arising out of required inspections by an authorized body.

6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.

7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.

2. Comply with all utility company requirements.

3. Make application for and pay for fire protection water service connection.

F. Examination of Drawings:

1. The drawings for the fire protection work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.

2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.

3. Scaling of the drawings is not sufficient or accurate for determining these locations.

4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.

6. If an item is either on the drawings or in the specifications, it shall be included in this contract.

7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.

8. Where used in fire protection documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
   a. Any item listed as furnished shall also be installed, unless otherwise noted.
   b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:
   1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:
   1. Construction drawings for this project have been prepared utilizing Revit.
   2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
   3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
   4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
   5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
   6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
   7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor’s use of these documents.

1.6 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

<table>
<thead>
<tr>
<th>Referenced Specification Section</th>
<th>Submittal Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 05 00</td>
<td>Owner Training Agenda</td>
</tr>
<tr>
<td>21 05 03</td>
<td>Fire Seal Systems</td>
</tr>
<tr>
<td>21 13 00</td>
<td>Sprinkler Systems</td>
</tr>
<tr>
<td>21 13 00</td>
<td>Fire Protection Equipment</td>
</tr>
</tbody>
</table>

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:
   a. Date
   b. Project title and number
   c. Contractor’s name and address
   d. Division of work (e.g., plumbing, heating, ventilating, etc.)
   e. Description of items submitted and relevant specification number
   f. Notations of deviations from the contract documents
   g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
   a. Date
   b. Project title and number
   c. Architect/Engineer
   d. Contractor and subcontractors’ names and addresses
   e. Supplier and manufacturer’s names and addresses
   f. Division of work (e.g., plumbing, heating, ventilating, etc.)
   g. Description of item submitted (using project nomenclature) and relevant specification number
   h. Notations of deviations from the contract documents
   i. Other pertinent data
   j. Provide space for Contractor’s review stamps

3. Composition:
   a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
   b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain...
items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).

c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers’ standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.

5. Contractor's Approval Stamp:

   a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.

   b. Unstamped submittals will be rejected.

   c. The Contractor’s review shall include, but not be limited to, verification of the following:

     1.) Only approved manufacturers are used.
     2.) Addenda items have been incorporated.
     3.) Catalog numbers and options match those specified.
     4.) Performance data matches that specified.
     5.) Electrical characteristics and loads match those specified.
     6.) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
     7.) Dimensions and service clearances are suitable for the intended location.
     8.) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
     9.) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

d. The Contractor shall review, stamp and approve all subcontractors’ submittals as described above.

e. The Contractor’s approval stamp is required on all submittals. Approval will indicate the Contractor’s review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract
documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:
   a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
   b. The Contractor shall clearly indicate the size, finish, material, etc.
   c. Where more than one model is shown on a manufacturer’s sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
   d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.

8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.

9. Reproduction of contract documents alone is not acceptable for submittals.

10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.

11. Submittals not required by the contract documents may be returned without review.

12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.

13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.

14. Contractor’s responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer’s approval.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.

2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.

3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. **File Names:** Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
   
a. Submittal file name: 21 XX XX.description.YYYYMMDD

b. Transmittal file name: 21 XX XX.description.YYYYMMDD

5. **File Size:** Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

### 1.7 SCHEDULE OF VALUES

A. The requirements herein are in addition to the provisions of Division 1.

B. **Format:**
   
   1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.

   2. Submit in Excel format.

   3. Support values given with substantiating data.

C. **Preparation:**
   
   1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.

   2. Break down all costs into:
      
      a. Material: Delivered cost of product with taxes paid.

      b. Labor: Labor cost, excluding overhead and profit.

D. **Update Schedule of Values when:**
   
   1. Indicated by Architect/Engineer.

   2. Change of subcontractor or supplier occurs.

   3. Change of product or equipment occurs.

### 1.8 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.

B. Change order work shall not proceed until authorized.
1.9 EQUIPMENT SUPPLIERS’ INSPECTION

A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:

1. Fire Seal Systems

B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.

C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner’s Operation and Maintenance Manuals.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.

B. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

C. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.11 WARRANTY

A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.12 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.
1.13 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality required.

B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications, and fits in the allocated space.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.

E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.

F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

1.14 LEED REQUIREMENTS

A. This project is pursuing a LEED Certified certification in accordance with USGBC LEED Rating System for New Construction v4. The Contractor shall provide all services and documentation necessary to achieve this rating.

1.15 PROJECT COMMISSIONING

A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 13 and provide all services necessary for compliance with LEED Prerequisite EAp1, Fundamental Commissioning, and EAc3 Enhanced Commissioning.

PART 2 - PRODUCTS
NOT APPLICABLE

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employee and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer
and the Architect/Engineer’s consultants shall be indemnified and shall be made additional insureds under the Contractor’s general liability insurance policy.

3.2 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The Contractor shall provide seven (7) calendar days’ notice to the Architect/Engineer prior to:

1. Covering exterior walls, interior partitions and chases.
2. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor’s schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer’s review. This includes, but is not limited to:
   a. Pipe wall penetrations are sealed.
   b. Pipe identification is installed.
   c. Branch piping in the location of sprinklers shall be dropped to the ceiling.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.

3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.3 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.

2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.

3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.

4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer’s additional time and expenses will be deducted from the Contractor’s contract retainage prior to final payment at the completion of the job.
C. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.

2. Record documents including marked-up drawings and specifications.

3. A report documenting the instructions given to the Owner’s representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner’s representatives.

4. Inspection report by the State Fire Marshal of the fire protection system.

5. Start-up reports on all equipment requiring a factory installation inspection or start-up.

6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.4 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer’s review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer’s comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.

2. Approved O&M manuals shall be completed and in the Owner’s possession prior to Owner’s acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.

2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.

3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

   a. O&M file name: O&M.div21.contractor.YYYYMMDD
   b. Transmittal file name: O&Mtransmittal.div21.contractor.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as “1 of 2”, “2 of 2”, etc.

6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title “Operation and Maintenance Instructions”, title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.

7. All text shall be searchable.

8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.

2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.

3. Copies of all final approved shop drawings and submittals. Include Architect’s/Engineer’s shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.

4. Copy of final approved test and balance reports.

5. Copies of all factory inspections and/or equipment startup reports.


7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.

8. Dimensional drawings of equipment.

9. Capacities and utility consumption of equipment.

10. Detailed parts lists with lists of suppliers.

11. Operating procedures for each system.

12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.

13. Repair procedures for major components.

14. List of lubricants in all equipment and recommended frequency of lubrication.

15. Instruction books, cards, and manuals furnished with the equipment.
3.5 INSTRUCTING THE OWNER'S REPRESENTATIVES

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The instructions shall include:
   1. Explanation of all system flow diagrams.
   2. Maintenance of equipment.
   3. Description of emergency system operation.

E. The Architect/Engineer shall be notified of the time and place instructions will be given to the Owner's representatives so he or his representative can attend if desired.

F. Minimum hours of instruction for each item shall be:
   1. Sprinkler System(s) - 2 hours.

G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.

H. Operating Instructions:
   1. Contractor is responsible for all instructions to the Owner's representatives for the fire protection and control systems.
   2. If the Contractor does not have staff that can adequately provide the required instructions he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.6 RECORD DOCUMENTS

A. The following paragraph supplements Division 1 requirements:

Contractor shall maintain at the job site a separate and complete set of fire protection drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the fire protection systems.

B. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations of other control devices, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and
numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.

C. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.

D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.7 PAINTING

A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.

B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor.

C. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.

D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer his color preference and furnish this color.

E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

F. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:

1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.

3.8 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.

B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.
3.9 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, etc., with other trades to maintain clear access area for servicing.

B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner’s designated representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner’s designated representative will result in removal and reinstallation of the equipment at the Contractor’s expense.

END OF SECTION 21 05 00
READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. Fire protection system operational.
3. Pipes labeled.

Accepted by:

Prime Contractor ________________________________

By ____________________________ Date ______________

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor’s contract retainage prior to final payment at the completion of the job.

* * * * *
SECTION 21 05 29
FIRE SUPPRESSION SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hangers, Supports, and Associated Anchors.
B. Equipment Bases and Supports.
C. Sleeves and Seals.
D. Flashing and Sealing of Equipment and Pipe Stacks.
E. Cutting of Openings.
F. Escutcheon Plates and Trim.

1.2 QUALITY ASSURANCE

A. Support Sprinkler Piping in conformance with NFPA 13.

1.3 REFERENCES

B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.4 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 HANGER RODS

A. Hanger rods for single rod hangers supporting steel, copper, and CPVC piping shall conform to the following:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Rod Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>4” and smaller</td>
<td>3/8”</td>
</tr>
</tbody>
</table>

B. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

C. All hanger rods, nuts, washers, clevises, etc., in damp areas shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

2.2 PIPE HANGERS AND SUPPORTS

A. General:

1. All pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS-SP-58, 69, 89.
B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, and more frequently when required by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings or lugs. Provide sufficient flexibility to accommodate expansion and contraction without compromising fire barrier penetrations and other fixed takeoff locations.

   Acceptable Products:
   - Anvil - Fig. CT121
   - Cooper/B-Line - Fig. B3373CT
   - Erico - Model 510
   - Nibco/Tolco - Fig. 82

2. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs.

3. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

C. Hangers and Clamps:

1. Hangers in direct contact with copper pipe shall be coated with plastic with appropriate temperature range.

2. Unless otherwise indicated, hangers shall be as follows:

   a. Clevis Type:
      Service: Bare Metal Pipe
      Acceptable Products:
      - Anvil: Fig. 260
      - Cooper/B-Line: Fig. 3100
      - Erico: Model 400
      - Nibco/Tolco: Fig. 1

   b. Adjustable Swivel Ring Type:
      Service: Bare Metal Pipe - 4 inches and Smaller
      Acceptable Products:
      - Anvil: Fig. 69
      - Cooper/B-Line: Fig. B3170NF
      - Erico: Model FCN
      - Nibco/Tolco: Fig. 200

3. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per
manufacturer’s installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.

4. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

5. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

6. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

   a. Clamp Type:
      Service: Bare Metal Pipe
      1) Clamps in direct contact with copper pipe shall be plastic coated.
      2) Pipes subject to expansion and contraction shall have clamps slightly oversized to allow limited pipe movement.

<table>
<thead>
<tr>
<th>Acceptable Products:</th>
<th>Bare Steel Pipe</th>
<th>Bare Copper Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unistrut</td>
<td>Fig. P1100 or P2500</td>
<td></td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B2000 or B2400 Fig. BVT</td>
<td></td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. A-14 or 2STR</td>
<td></td>
</tr>
</tbody>
</table>

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

   a. Steel Structure Clamps:

      1) C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists.):

         | Acceptable Products:  |
         |-----------------------|
         | Anvil                 | Fig. 92               |
         | Cooper/B-Line         | Fig. B3033/B3034      |
         | Erico                 | Model 300             |
         | Nibco/Tolco           | 68                    |

      2) Scissor Type Beam Clamps (for use with bar-joists and wide flange):

         | Acceptable Products:    |
         |-------------------------|
         | Anvil                   | Fig. 228, 292          |
         | Cooper/B-Line           | Fig. B3054             |
         | Erico                   | Model 360              |
         | Nibco/Tolco             | Fig. 329               |
b. Concrete:

1) Concrete Inserts, Single Rod Galvanized:

Acceptable Products:

<table>
<thead>
<tr>
<th>Product</th>
<th>Fig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anvil</td>
<td>282</td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>B3014</td>
</tr>
<tr>
<td>Erico</td>
<td>Model 355</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>310</td>
</tr>
</tbody>
</table>

2) Concrete Inserts, Continuous Strip Galvanized:

Acceptable Products:

<table>
<thead>
<tr>
<th>Product</th>
<th>Fig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unistrut Corp</td>
<td>P3200 Series</td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>B22-J</td>
</tr>
<tr>
<td>Erico</td>
<td>CONCT</td>
</tr>
</tbody>
</table>

c. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

2. Steel Structure Welding:

a. Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and for protecting walls and ceilings from being damaged by smoke.

2.3 OPENINGS IN FLOORS, WALLS AND CEILINGS

A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.

B. Coordinate all openings with other Contractors.

C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.

D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at his expense.

E. Do not cut structural members without written approval of the Architect or Structural Engineer.
2.4 PIPE SLEEVES AND LINTELS

A. Each Contractor shall provide pipe sleeves and lintels for all openings required for the Contractor’s work in masonry walls and floors, unless specifically shown as being by others.

B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.

C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.

D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1” above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.

E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Engineer’s design.

F. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.

G. Where pipes rise through concrete floors that are on earthen grade, provide 3/4” resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.

H. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

2.5 ESCUTCHEON PLATES AND TRIM

A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.

B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.

C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes duct and pipe openings.

2.6 PIPE PENETRATIONS

A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.

B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.7 PIPE ANCHORS

A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.
B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.8 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 FIRE SUPPRESSION SUPPORTS AND ANCHORS

A. General Installation Requirements:
   1. Install all items per manufacturer's instructions.
   2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
   3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

B. Supports Requirements:
   1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
   2. Set all concrete inserts in place before pouring concrete.
   3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
   4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
   5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:
   1. Support all piping and equipment, including valves, strainers, and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
   2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
   3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
   4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.

6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.

7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.

8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3 spacing between loads.

2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
   a. The hanger is attached within 6” from a web/chord joint.
   b. Additional L2x2x1/4 web reinforcement is installed per manufacturer’s requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.

4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4” below bottom face of lowest fastener and blunt any sharp edges.

F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2’-0” on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2’-0” spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.

H. Spacing of hangers shall in no case exceed the following:

<table>
<thead>
<tr>
<th>Pipe Material</th>
<th>Maximum Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Steel (All steel pipe unless otherwise noted):</td>
<td></td>
</tr>
<tr>
<td>1-1/4” &amp; under</td>
<td>12’-0”</td>
</tr>
<tr>
<td>1-1/2” &amp; larger</td>
<td>15’-0”</td>
</tr>
<tr>
<td>2. Steel (Schedule 40 lightweight alternative):</td>
<td></td>
</tr>
<tr>
<td>3” &amp; under</td>
<td>12’-0”</td>
</tr>
<tr>
<td>Pipe Material</td>
<td>Maximum Spacing</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>3. Hard Drawn Copper:</td>
<td></td>
</tr>
<tr>
<td>1&quot; &amp; under</td>
<td>8'-0&quot;</td>
</tr>
<tr>
<td>1-1/4&quot; to 1-1/2&quot;</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>2&quot; to 3&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>3-1/2&quot; &amp; larger</td>
<td>15'-0&quot;</td>
</tr>
</tbody>
</table>

I. Installation of hangers shall conform to MSS SP-58, 69, 89, and applicable NFPA standards.

END OF SECTION 21 05 29
SECTION 21 05 53
FIRE SUPPRESSION IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Identification of products installed under Division 21.

1.2 REFERENCES
B. ASTM B-1, B-3, and B-8 for copper conductors.
C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 – 2kv Cables.
D. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

2.2 MATERIALS
A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

<table>
<thead>
<tr>
<th>OD of Pipe or insulation</th>
<th>Marker Length</th>
<th>Size of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to and including 1-1/4&quot;</td>
<td>8&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>1-1/2&quot; to 2&quot;</td>
<td>8&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; to 6&quot;</td>
<td>12&quot;</td>
<td>1-1/4&quot;</td>
</tr>
</tbody>
</table>

Plastic tags may be used for outside diameters under 3/4".

B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.

C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.

D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.

E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.
F. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.

G. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all products per manufacturer’s recommendations.

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Valves:
   1. All valves (except shutoff valves at equipment) shall have numbered tags.
   2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
   3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
   4. Secure tags with heavy duty key chain and brass “S” link or with mechanically fastened plastic straps.
   5. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.
   6. Number all tags and show the service of the pipe.
   7. Provide two sets of laminated 8-1/2” x 11” copies of a valve directory listing all valves, with respective tag numbers, uses, and locations. The directory shall be reviewed by the Owner and Architect/Engineer prior to laminating final copies. Laminated copies shall have brass eyelet in at least one corner for easy hanging.

D. Pipe Markers:
   1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3” diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3” diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
   2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8” OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
   3. Apply markers and arrows in the following locations where clearly visible:
      a. At each valve.
      b. On both sides of walls that pipes penetrate.
      c. At least every 20 feet along all pipes.
      d. On each riser and each leg of each “T” joint.
      e. At least once in every room and each story traversed.
E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.

2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.

3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

3.2 SCHEDULE

A. Pipes to be marked shall be labeled with the text as shown in the following table regardless of which method or material is used:

<table>
<thead>
<tr>
<th>Pipe Service</th>
<th>Lettering Color</th>
<th>Background Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRE PROTECTION WATER</td>
<td>White</td>
<td>Red</td>
</tr>
</tbody>
</table>

END OF SECTION 21 05 53
PART 1 - GENERAL

1.1 SECTION INCLUDES
   B. Wet-Pipe Sprinkler System.

1.2 QUALITY ASSURANCE
   A. Equipment and Components: Bear UL label or marking.
   B. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body. Pressure rating shall match specified pipe system pressure rating. Remanufactured valves are not acceptable.
   C. Specialist Firm: Company specializing in sprinkler systems with minimum three years' experience.
   D. Sprinkler design drawings submitted by the Contractor shall be prepared by a NICET Water-Based Fire Protection Systems Layout Level III or Level IV designer or PE, and signed and sealed by a Professional Engineer licensed in the state where the project is located.
   E. All work shall be in accordance with NFPA 13.

1.3 REFERENCES
   B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300.
   C. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
   D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
   F. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
   H. ANSI/ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
   I. ANSI/ASME Section 9 - Welding and Brazing Qualifications.
   M. ANSI/WWA C151 - Ductile Iron Pipe, Centrifugally Cast.
N. ASME - Boiler and Pressure Vessel Code - Section IX, Welding and Brazing Requirements.
O. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
P. AWS A5.8 - Brazing Filler Metal.
Q. AWS B2.2 - Standard for Brazing Procedure and Performance Qualification.
R. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
S. BOCA National Building Code.
U. NFPA 101 - Life Safety Code,
V. NFPA 13 - Installation of Sprinkler Systems.
X. UL - Underwriter's Laboratory Fire Protection Equipment Directory.

1.4 SUBMITTALS

A. Submit shop drawings per Section 21 05 00. Indicate pipe materials, joining methods, supports, floor and wall penetration seals, sprinklers, equipment data and ratings, and hydraulic calculations.

B. Submit detailed pipe and sprinkler layout and other calculations and forms as described in NFPA 13.

C. Submit detailed working drawings and obtain review of them in the following order:
   1. Engineer/Architect.
   2. State Fire Marshal/Authority Having Jurisdiction
   3. Owner's Insurance Company
   4. Architect/Engineer

Begin construction after all approvals are received.

D. Working drawings shall include piping and sprinkler layout, sprinkler types and ratings, sections and elevations at critical points. Show coordination with lighting, ductwork, and diffusers, and indicate basic flow and hydraulic design information, including main location and date that the test was taken.

1.5 EXTRA STOCK

A. Provide metal storage cabinet, wrenches for each sprinkler type, and extra sprinklers per NFPA 13 and applicable building code.
1.6 DELIVERY, STORAGE, AND HANDLING
   A. Store valves and sprinklers in shipping containers, with labels in place.
   B. Provide temporary protective coating on iron and steel valves.
   C. Maintain temporary end caps and closures in place until installation.

1.7 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS
   A. Furnish sleeves to General Contractor for placement in walls and floors. Sleeve location to be determined by the Fire Protection Contractor prior to construction. If additional sleeves are required, they shall be core drilled by the Fire Protection Contractor.

1.8 SYSTEM DESCRIPTION
   A. System shall cover building areas noted.
   B. System shall interface with building fire alarm system. Provide all required wiring.
   C. Provide wet pipe sprinkler system to NFPA 13 and building code requirements as required by Owner’s insurance company and as shown on the drawings.
   D. Provide a Fire Department connection.

1.9 REGULATORY REQUIREMENTS
   A. All material, equipment, and installation shall be approved by the Authorities Having Jurisdiction and the Owner’s Insurance Company.
   B. The Authorities Having Jurisdiction and the Owner’s Insurance Company shall have precedence over the drawings and specifications in case of discrepancies.
   C. The entire installation shall comply with all applicable codes.

1.10 SYSTEM DESIGN
   A. Design and install a complete, hydraulically calculated wet-pipe sprinkler system for the entire building.
   B. Provide all required equipment and accessories.
   C. System shall include a 5 psi allowance for future decrease in available pressure and an allowance for inside and outside hose streams.
   D. Provide monitor switches on all shutoff valves.
   E. Install sprinkler riser in location shown on drawings or as approved by the Architect/Engineer.
   F. Provide pressure gauge with valve in the main riser.
   G. Provide main drain valve piped to outside the building. Locate so discharge does not damage lawn or other surfaces.
   H. Provide flow switch in the main riser and as indicated on drawings.
1.11 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 21 05 00 for required fire protection systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

1.12 OPERATION AND MAINTENANCE DATA

A. Submit manufacturers' operation and maintenance data. Include written maintenance data on components of system, servicing requirements, and record drawings.

1.13 JOB CONDITIONS

A. Fire Protection Contractor shall determine the flow and pressure available at the service connection. The Fire Protection Contractor is responsible to verify this information and make all tests required. Base all pipe sizing and hydraulic calculations on flow test data no older than 18 months.

B. Local fire authority or third-party consultant shall be contracted to determine the flow and pressure available at the service connection. The Fire Protection Contractor is responsible to verify this information and make all tests required. Base all pipe sizing and hydraulic calculations on flow test data no older than six (6) months.

C. Pipe sizing shown on drawings for service entrance and main risers is preliminary for coordination purposes only. Contractor is responsible for final sizing from hydraulic calculations.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS - WET PIPE SPRINKLER SYSTEMS

A. Piping – 2" and Under:

1. Design Pressure: 175 psig.


3. Joints: Threaded or flanged.

4. Fittings:

   a. Threaded:

      1) Cast iron, Class 125, black, UL/FM, ANSI/ASME B16.4.

      2) Malleable iron, Class 150, black, UL/FM, ANSI/ASME B16.3.

      3) Ductile iron, Class 150, black UL/FM, ANSI/ASME B16.3.

5. Unions: Class 150 malleable iron, ANSI B16.39, ground joint with copper or copper alloy-to-iron seat.

B. Piping – 2-1/2" and Above:

1. Design Pressure: 175 psig.
2. Pipe: Schedule 10, black steel, ASTM A135, ASTM A795, UL/FM. Inner wall shall be coated with an anti-MIC (microbiologically influenced corrosion) coating.
   a. Joints: Grooved or flanged.
   b. Fittings:
      1) Grooved:
         a) Ductile iron housing ASTM A-536, Grade 65-45-12, UL/FM, enamel coating, Grade E (Type A) EPDM molded pressure-responsive gaskets suited for 40°F to 150°F. Carbon steel bolts and nuts.
      2) Flanged:
         a) Cast iron, Class 125, black, UL/FM, ANSI/ASME B16.1.

2.2 VALVE OPERATORS
   A. Provide handwheels for gate valves. Provide gear operators for butterfly valves.

2.3 VALVE CONNECTIONS
   A. Provide all connections to match pipe joints. Valves shall be same size as pipe.

2.4 BACKFLOW PREVENTERS
   A. Provide backflow preventers as required by code and as specified on the drawings.

2.5 EQUIPMENT
   A. Equipment shall be as scheduled on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION - PIPING
   A. General Installation Requirements:
      1. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over sprinkler piping and sprinklers.
      2. Ream pipe and tube ends to full inside diameter. Remove burrs. Remove scale and foreign material, inside and outside, before assembly.
      3. Die cut screw joints with full cut standard taper pipe threads.
      4. Coat threads with pipe joint compound or wrap with Teflon tape.
      5. Locate piping to minimize obstruction of other work.
      6. Route piping in concealed spaces above finished ceiling.
      7. Use full and double lengths of pipe wherever possible.
8. Slope all piping for complete drainage. Install auxiliary drains for all trapped piping per NFPA 13.

9. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.

10. Comply with manufacturer’s installation instructions.

B. Steel Piping:

1. In steel piping, main sized saddle branch connections or direct connection of branches to main is permitted if main is one pipe size larger than the branch for up to 6” mains. Do not project branch pipes into main pipes.

C. Wall/Floor Penetration:

1. Provide sleeves when penetrating floors and walls.

2. Seal pipes passing through exterior walls with a wall seal per Section 21 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe. Sleeves through floors shall extend minimum 1.5” above finished floor.

3. Fire seal all pipe and sleeve penetrations (both wall and floor) to maintain fire separation required without restraining pipe.

D. Installation Requirements in Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment. Fire protection equipment dedicated to the electrical equipment room or space may be installed above equipment if other alternatives are not available.

E. Hangers and Supports:

1. Provide hangers and supports as required by NFPA 13 and UL with the following exceptions:

   a. Do not use powder driven devices, explosive devices, wooden plugs, or plastic inserts.

   b. Do not install fasteners to carry the load in tension, unless absolutely necessary.

F. Exposed Piping:

1. Install chrome plated steel escutcheons where exposed pipes penetrate walls or floors.
3.2 INSTALLATION - VALVES

A. Install gate valves with stems upright or horizontal, not inverted.

B. Backflow Preventer:
   1. Units shall be field tested and tagged in accordance with manufacturer’s instructions by a certified tester before initial operation.
   2. Install unit between 12" and 60" above finish floor.

3.3 INSTALLATION - EQUIPMENT

A. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over system equipment and sprinklers.

B. Fire Department Connection:
   1. Locate fire department connection in an accessible location as approved by the local fire department with sufficient clearance from walls, obstructions, and adjacent Siamese connectors to allow full swing of fire department wrench handle.

C. Test Valves:
   1. Install test valves where required. Pipe to outdoors or drain. Test connection shall have flow equivalent to the smallest K-factor sprinkler.

D. Sprinklers:
   1. Locate sprinklers to clear lights, ducts and diffusers. Do not run sprinkler pipes through ducts. Ductwork has priority over sprinkler pipes. Offset pipes as needed.
   2. Center sprinklers in two directions in ceiling tiles and provide offsets as required.
   3. Do not allow concealed sprinkler cover plates to be painted. Sprinkler cover plates are to be factory painted only. Do not field paint.
   4. Apply strippable or paper covers so concealed sprinkler cover plates do not receive field paint finish.

3.4 SYSTEMS CLEANING AND TESTING

A. General Requirement:
   1. All water used for testing and remaining in the piping system shall be obtained from a potable water source.

B. Underground Piping:
   1. Flush all underground piping with minimum flow equal to the system design flow but not less than the following:
      a. 390 gpm for 4" pipes.
2. Branches from existing or new underground mains to sprinkler risers shall be flushed out through two 2-1/2" hoses (with flow through open hose butts) attached to the riser with 4" temporary piping. Flushing through the drain of an alarm check or dry pipe valve is not acceptable.

C. Interior Piping:

1. Verify adequate water flow at the inspector's test connection.

2. Flush all interior piping to remove scale and other foreign material before placing system into service.

3. Hydrostatically test the entire interior piping system at a minimum of 200 psig or 50 psig more than the normal system working pressure for systems subjected to pressures more than 150 psig. Maintain test pressure for 2 hours without loss of pressure.

D. Fire Alarm System:

1. Test the alarm system by operating the inspector's test connection or the alarm test valves. Verify that the building fire alarm system activates.

2. Adjust all monitor switches for proper operation.

END OF SECTION 21 13 00
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.

B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make his portion of the Mechanical Work a finished and working system.

C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

D. Scope of Work:

1. **Plumbing Work** shall include, but is not necessarily limited to:

   a. Furnish and install all items listed in the Plumbing Material List.

   b. Furnish and install a new domestic water service to the building.

   c. Furnish and install water meters and domestic water backflow preventers as required by Code.

   d. Furnish and install a complete domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.

   e. Furnish and install gas piping system including all meter requirements.

   f. Furnish and install water heaters.

   g. Furnish and install a new fire protection service to the building including backflow preventer as required by Code.

   h. Furnish and install a complete storm water drainage system.

   i. Furnish and install condensate drain piping from plumbing related equipment such as ice machines.

   j. Furnish and install a complete sanitary sewer and vent system.
k. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

2. **Air Conditioning and Ventilating Work** shall include, but is not necessarily limited to:
   a. Furnish and install package indoor air handling units complete with dampers, filters, coils, fans, and motors.
   b. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
   c. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
   d. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
   e. Furnish and install mechanical room ventilation systems including louvers, ductwork, insulation, and fans.
   f. Furnish and install gas flues, stacks, and breechings.
   g. Furnish and install all temperature control systems.
   h. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.
   i. Furnish and install refrigerant piping, accessories, and final charge of refrigerant.
   j. Furnish and install condensate drain piping from cooling related equipment such as air handlers and cooling coil drain pans.

3. **Temperature Control Work** shall include, but is not necessarily limited to:
   a. Furnish and install a complete temperature control system as specified in Section 23 09 00.
   b. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.
   c. Furnish automatic control valves and dampers for installation by others.
   d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

4. **Fire Protection Work** shall include, but is not necessarily limited to:
   a. Furnish and install a complete wet pipe sprinkler system for areas noted on the drawings.
   b. Furnish and install all items listed on the Fire Protection Material List.
   c. Furnish all hydraulic calculations and working sprinkler drawings.
d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor’s work.

5. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:

a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, plumbing systems, and verification of control systems.

1.3 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

1. "Mechanical Contractors" refers to the following:

a. Plumbing Contractor.

b. Air Conditioning and Ventilating Contractor.

c. Temperature Control Contractor.

d. Fire Protection Contractor.

e. Testing, Adjusting, and Balancing Contractor.

2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.

3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.

4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.

5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.

a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as
temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.

2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.

3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.

4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.

5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:

   a. Light fixtures.
   b. Gravity flow piping, including condensate.
   c. Electrical busduct.
   d. Sheet metal.
   e. Electrical cable trays, including access space.
   f. Sprinkler piping and other piping.
   g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:

   a. Makeup Air Units.
   b. Gas Trains.
   c. Package Air Handling Units.

2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.

3. Temperature Control Contractor's Responsibility:

   a. Wiring of all devices needed to make the Temperature Control System functional.
   b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not
shown on the electrical drawings, is the responsibility of the Temperature Control Contractor.

c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.

2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.

3. Provides motor control and temperature control wiring, where so noted on the drawings.

4. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.

5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.4 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.

b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5” and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5” and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
d. Maintenance clearances and code-required dedicated space shall be included.

e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.

2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

   a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an “Electronic File Transfer” waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

   a. Scale of drawings:

      1) General plans: 1/4 Inch = 1 '-0" (minimum).

      2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).

      3) Risers: 1/2 Inch = 1'-0" (minimum).

      4) Mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).

      5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.

4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner’s Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.

2. A plotted set of coordination drawings shall be available at the project site.

3. Coordination drawings are not shop drawings and shall not be submitted as such.

4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.

5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.

6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.

7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.

8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.

9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

   a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.

   b. Potential layout changes shall be made to avoid additional access panels.

   c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.

   d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.

   e. When additional access panels are required, they shall be provided without additional cost to the Owner.
10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.

11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements or installed their work without proper coordination.

12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.5 QUALITY ASSURANCE

A. Contractor’s Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.

2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor’s own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor’s risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.

2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Des Moines, Iowa’s Codes, Laws, Ordinances and other regulations having jurisdiction.

2. Conform to all State Codes.

3. Conform to Federal Act S.3874 requiring the reduction of lead in drinking water.

4. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.

5. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.
6. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.

7. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.

8. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.

2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.

3. Pay all charges for permits or licenses.

4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.

5. Pay all charges arising out of required inspections by an authorized body.

6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.

7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter’s Laboratories, Inc.

E. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.

2. Comply with all utility company requirements.

3. Make application for and pay for service connections, such as sewer, water, and gas.

4. Make application for and pay for all meters and metering systems required by the utility company.

F. Examination of Drawings:

1. The drawings for the plumbing work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.

2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.

4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.

5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.

6. If an item is either on the drawings or in the specifications, it shall be included in this contract.

7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.

8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.
   a. Any item listed as furnished shall also be installed, unless otherwise noted.
   b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.

2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.

3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.

4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.

5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.

6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor’s use of these documents.

1.6 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

<table>
<thead>
<tr>
<th>Referenced Specification Section</th>
<th>Submittal Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 05 00</td>
<td>Owner Training Agenda</td>
</tr>
<tr>
<td>22 05 03</td>
<td>Fire Seal Systems</td>
</tr>
<tr>
<td>22 11 23</td>
<td>Domestic Water Pumps</td>
</tr>
<tr>
<td>Refer to drawings</td>
<td>Plumbing Material List Items</td>
</tr>
</tbody>
</table>

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

   a. Date
   b. Project title and number
   c. Contractor’s name and address
   d. Division of work (e.g., plumbing, heating, ventilating, etc.)
   e. Description of items submitted and relevant specification number
   f. Notations of deviations from the contract documents
   g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

   a. Date
   b. Project title and number
   c. Architect/Engineer
   d. Contractor and subcontractors’ names and addresses
   e. Supplier and manufacturer’s names and addresses
   f. Division of work (e.g., plumbing, heating, ventilating, etc.)
   g. Description of item submitted (using project nomenclature) and relevant specification number
   h. Notations of deviations from the contract documents
   i. Other pertinent data
   j. Provide space for Contractor’s review stamps

3. Composition:

   a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).

c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers’ standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.

5. Contractor’s Approval Stamp:

a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.

b. Unstamped submittals will be rejected.

c. The Contractor’s review shall include, but not be limited to, verification of the following:

1) Only approved manufacturers are used.

2) Addenda items have been incorporated.

3) Catalog numbers and options match those specified.

4) Performance data matches that specified.

5) Electrical characteristics and loads match those specified.

6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.

7) Dimensions and service clearances are suitable for the intended location.

8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.

9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

d. The Contractor shall review, stamp and approve all subcontractors’ submittals as described above.
e. The Contractor’s approval stamp is required on all submittals. Approval will indicate the Contractor’s review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:
   a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
   b. The Contractor shall clearly indicate the size, finish, material, etc.
   c. Where more than one model is shown on a manufacturer’s sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
   d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.

8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.

9. Reproduction of contract documents alone is not acceptable for submittals.

10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.

11. Submittals not required by the contract documents may be returned without review.

12. The Architect/Engineer’s responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.

13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.

14. Contractor’s responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer’s approval.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.

2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. **Format:** Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. **File Names:** Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
   - Submittal file name: 22 XX XX.description.YYYYMMDD
   - Transmittal file name: 22 XX XX.description.YYYYMMDD

5. **File Size:** Electronic file size shall be limited to a maximum of 4MB. Larger files shall be transmitted via a pre-approved method.

### 1.7 SCHEDULE OF VALUES

A. The requirements herein are in addition to the provisions of Division 1.

B. **Format:**
   1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
   2. Submit in Excel format.
   3. Support values given with substantiating data.

C. **Preparation:**
   1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
   2. Break down all costs into:
      - Material: Delivered cost of product with taxes paid.
      - Labor: Labor cost, excluding overhead and profit.

D. **Update Schedule of Values when:**
   1. Indicated by Architect/Engineer.
   2. Change of subcontractor or supplier occurs.
   3. Change of product or equipment occurs.

### 1.8 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders with inadequate breakdown will be rejected.

B. Change order work shall not proceed until authorized.
1.9 EQUIPMENT SUPPLIERS' INSPECTION

A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:

1. Fire Seal Systems

B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.

C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.

B. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

C. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.11 WARRANTY

A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.12 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.
1.13 MATERIAL SUBSTITUTE

A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality required.

B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.

E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.

F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

1.14 LEED REQUIREMENTS

A. This project is pursuing a LEED Certified certification in accordance with USGBC LEED Rating System for New Construction v4. The Contractor shall provide all services and documentation necessary to achieve this rating.

1.15 PROJECT COMMISSIONING

A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 13 and provide all services necessary for compliance with LEED Prerequisite EAp1, Fundamental Commissioning, and EAc3 Enhanced Commissioning.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employee and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer
and the Architect/Engineer’s consultants shall be indemnified and shall be made additional insureds under the Contractor’s general liability insurance policy.

### 3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

**A. General:**

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.

2. The Contractor shall do all excavating, filling, backfilling and compacting associated with his work.

**B. Excavation:**

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.

2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.

3. Trim bottom and sides of excavations to grades required for foundations.

4. Protect excavations against frost and freezing.

5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.

6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.

7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.

8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

**C. Dewatering:**

1. Contractor shall furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

**D. Underground Obstructions:**

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. No rubbish or waste material is permitted for fill or backfill.
2. Provide all necessary sand for backfilling.
3. Dispose of the excess excavated earth as directed.
4. Backfill materials shall be suitable for required compaction, clean and free of perishable materials and stones greater than 4 inches in diameter. Water shall not be permitted to rise in unbackfilled trenches. No material shall be used for backfilling that contains frozen earth, debris or earth with a high void content.
5. Backfill all trenches and excavations immediately after installing pipes, or removal of forms, unless other protection is provided.
6. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.
7. Lay all piping on a compacted bed of sand at least 3 inches deep. Backfill around pipes with sand, 6 inch layers, and compact each layer.
8. Use sand for backfill up to grade for all piping under slabs or paved areas. All other piping shall have sand backfill to 6 inches above the top of the pipe.
9. Place all backfill above the sand in uniform layers not exceeding 6 inches deep. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
10. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T-99 or ASTM D-698 test.

F. Surface Restoration:

1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.
3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
   a. Pipe insulation is installed and fully sealed.
   b. Pipe wall penetrations are sealed.
   c. Pipe identification and valve tags are installed.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.

3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.4 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.

2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.

3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.

4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.
C. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including marked-up drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer’s review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer’s comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.

2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.

2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.

3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
   a. O&M file name: O&M.div22.contractor.YYYYMMDD
   b. Transmittal file name: O&Mtransmittal.div22.contractor.YYYYMMDD
5. File Size: Electronic file size shall be limited to a maximum of 4MB. Larger files shall be divided into files that are clearly labeled as “1 of 2”, “2 of 2”, etc.

6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title “Operation and Maintenance Instructions”, title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.

7. All text shall be searchable.

8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.

2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.

3. Copies of all final approved shop drawings and submittals. Include Architect’s/Engineer’s shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.

4. Copy of final approved test and balance reports.

5. Copies of all factory inspections and/or equipment startup reports.


7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.

8. Dimensional drawings of equipment.

9. Capacities and utility consumption of equipment.

10. Detailed parts lists with lists of suppliers.

11. Operating procedures for each system.

12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.

13. Repair procedures for major components.

14. List of lubricants in all equipment and recommended frequency of lubrication.

15. Instruction books, cards, and manuals furnished with the equipment.
3.6 INSTRUCTING THE OWNER'S REPRESENTATIVES

A. Adequately instruct the Owner’s designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner’s representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The instructions shall include:
   1. Explanation of all system flow diagrams.
   2. Maintenance of equipment.
   3. Start-up procedures for all major equipment.
   4. Explanation of seasonal system changes.

E. The Architect/Engineer shall be notified of the time and place instructions will be given to the Owner’s representatives so he or his representative can attend if desired.

F. Minimum hours of instruction for each item shall be:
   1. Domestic Hot Water System - 2 hours.

G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.

H. Operating Instructions:
   1. Contractor is responsible for all instructions to the Owner’s representatives for the mechanical and control systems.
   2. If the Contractor does not have staff that can adequately provide the required instructions he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

A. The plumbing systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final adjustments as required.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and
protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.

C. Contractor shall adjust the plumbing systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.

D. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

E. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

A. The following paragraph supplements Division 1 requirements:

Contractor shall maintain at the job site a separate and complete set of plumbing drawings and specifications on which he shall clearly and permanently mark in complete detail all changes made to the plumbing systems.

B. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations devices, requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.

C. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.

D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.9 PAINTING

A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.
B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor.

C. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.

D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer his color preference and furnish this color.

E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinishing with the same paint as was factory applied.

F. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.

G. Paint all outdoor exposed natural gas piping the color selected by Owner or Architect/Engineer.

H. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:

1. **Bare Metal Surfaces** - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.

2. **Insulated Surfaces** - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.

### 3.10 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.

B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

### 3.11 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.

B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner’s designated representative prior to setting equipment.
C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner’s designated representative will result in removal and reinstallation of the equipment at the Contractor’s expense.

END OF SECTION 22 05 00
READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All pumps operating and balanced.
3. All plumbing fixtures installed and caulked.
4. Pipe insulation complete, pipes labeled and valves tagged.

Accepted by:

Prime Contractor _______________________________________________

By _______________________________ Date _____________________

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * *
SECTION 22 05 03
THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.
B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

B. UL 723 - Surface Burning Characteristics of Building Materials
C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops
D. UL 2079 - Tests for Fire Resistance of Building Joint Systems
E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)
F. Intertek / Warnock Hersey - Directory of Listed Products
I. The Building Officials and Code Administrators National Building Code
J. 2015 International Building Code

1.4 SUBMITTALS

A. Submit under provisions of Section 22 05 00.
B. Submit Firestopping Installers Certification for all installers on the project.
C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer’s installation instructions, and UL or Intertek / Warnock Hersey Assembly number.
D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.

3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

4. F and T ratings for each firestop system.

E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer’s instructions for storage.

B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.

2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings:

   a. Floor penetrations located outside wall cavities.

   b. Floor penetrations located outside fire-resistance-rated shaft enclosures.

3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq. ft at both ambient temperature and 400°F for smoke barriers.
C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical
damage, provide products that, after curing, do not deteriorate when exposed to these
conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-
spread and smoke-developed indexes of less than 25 and 450, respectively, as determined
per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-
spread and smoke-developed indexes of less than 25 and 50, respectively, as determined
per ASTM E 84.

1.7 MEETINGS

A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include
the General Contractor, all Subcontractors associated with the installation of systems
penetrating fire barriers, Firestopping Manufacturer’s Representative, and the Owner.

1. Review foreseeable methods related to firestopping work.

2. Tour representative areas where firestopping is to be installed; inspect and discuss
each type of condition and each type of substrate that will be encountered, and
preparation to be performed by other trades.

1.8 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion,
cohesion, abrasion resistance, weather resistance, extrusion resistance, migration
resistance, stain resistance, general durability, or appear to deteriorate in any manner not
clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration
firestop systems indicated for each application that are produced by one of the following
manufacturers. All firestopping systems installed shall be provided by a single
manufacturer.

1. 3M; Fire Protection Produces Division.
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk.
4. Tremco; Sealant/Weatherproofing Division.
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Dow Corning Corp.
10. Fire Trak Corp.
11. International Protective Coating Corp.
2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB’s, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.

E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated

<table>
<thead>
<tr>
<th>Penetrating Item</th>
<th>UL System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Penetrating Item</td>
<td>FC 0000-0999*</td>
</tr>
<tr>
<td>Metallic Pipe or Conduit</td>
<td>FC 1000-1999</td>
</tr>
<tr>
<td>Non-Metallic Pipe or Conduit</td>
<td>FC 2000-2999</td>
</tr>
<tr>
<td>Electrical Cables</td>
<td>FC 3000-3999</td>
</tr>
<tr>
<td>Cable Trays</td>
<td>FC 4000-4999</td>
</tr>
<tr>
<td>Insulated Pipes</td>
<td>FC 5000-5999</td>
</tr>
<tr>
<td>Bus Duct and Misc. Electrical</td>
<td>FC 6000-6999</td>
</tr>
<tr>
<td>Duct without Damper and Misc. Mechanical</td>
<td>FC 7000-7999</td>
</tr>
<tr>
<td>Multiple Penetrations</td>
<td>FC 8000-8999</td>
</tr>
</tbody>
</table>

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated

<table>
<thead>
<tr>
<th>Penetrating Item</th>
<th>UL System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Penetrating Item</td>
<td>WL 0000-0999*</td>
</tr>
<tr>
<td>Metallic Pipe or Conduit</td>
<td>WL 1000-1999</td>
</tr>
<tr>
<td>Non-Metallic Pipe or Conduit</td>
<td>WL 2000-2999</td>
</tr>
<tr>
<td>Electrical Cables</td>
<td>WL 3000-3999</td>
</tr>
<tr>
<td>Cable Trays</td>
<td>WL 4000-4999</td>
</tr>
<tr>
<td>Insulated Pipes</td>
<td>WL 5000-5999</td>
</tr>
<tr>
<td>Penetrating Item</td>
<td>UL System No.</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Bus Duct and Misc. Electrical</td>
<td>WL 6000-6999</td>
</tr>
<tr>
<td>Duct without Damper and Misc. Mechanical</td>
<td>WL 7000-7999</td>
</tr>
<tr>
<td>Multiple Penetrations</td>
<td>WL 8000-8999</td>
</tr>
</tbody>
</table>

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated

F Rating = Wall/Floor Rating  
T Rating (Floors) = Floor Rating

<table>
<thead>
<tr>
<th>Penetrating Item</th>
<th>UL System No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Penetrating Item</td>
<td>CAJ 0000-0999*</td>
</tr>
<tr>
<td>Metallic Pipe or Conduit</td>
<td>CAJ 1000-1999</td>
</tr>
<tr>
<td>Non-Metallic Pipe or Conduit</td>
<td>CAJ 2000-2999</td>
</tr>
<tr>
<td>Electrical Cables</td>
<td>CAJ 3000-3999</td>
</tr>
<tr>
<td>Cable Trays</td>
<td>CAJ 4000-4999</td>
</tr>
<tr>
<td>Insulated Pipes</td>
<td>CAJ 5000-5999</td>
</tr>
<tr>
<td>Bus Duct and Misc. Electrical</td>
<td>CAJ 6000-6999</td>
</tr>
<tr>
<td>Duct without Damper and Misc. Mechanical</td>
<td>CAJ 7000-7999</td>
</tr>
<tr>
<td>Multiple Penetrations</td>
<td>CAJ 8000-8999</td>
</tr>
</tbody>
</table>

*Alternate method of firestopping is patching opening to match original rated construction.

H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer’s information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.
3.2 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer’s printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 IDENTIFICATION

A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:

1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."

2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer’s representative name, address, and phone number.

3.5 INSPECTION

A. All penetrations shall be inspected by the manufacturer’s representative to ensure proper installation.

B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.
D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer’s instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the engineer and manufacturer’s factory representative. The engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer’s specific instructions and details, all firestop systems are subject to destructive review and replacement at the engineer’s discretion and the contractor’s expense.

END OF SECTION 22 05 03
SECTION 22 05 13
MOTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Single Phase and Three Phase Electric Motors.

1.2 REFERENCES
A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
D. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
E. ANSI/NEMA MG 1 - Motors and Generators.

1.3 DELIVERY, STORAGE, AND HANDLING
A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof coverings. For extended outdoor storage, follow manufacturer’s recommendations for equipment and motor.

1.4 OPERATION AND MAINTENANCE DATA
A. Submit operation and maintenance data including assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.5 QUALIFICATIONS
A. Manufacturer: Company specializing in the manufacture of commercial and industrial motors and accessories, with a minimum of three years documented manufacturing experience.

PART 2 - PRODUCTS

2.1 GENERAL CONSTRUCTION AND REQUIREMENTS
A. Refer to the drawings for required electrical characteristics.
B. Design motors for continuous operation in 40ºC environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
C. Visible Nameplate: Indicating horsepower, voltage, phase, hertz, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, insulation class.

D. Electrical Connection: Boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

E. Motors 3/4 HP and smaller shall be single phase, 60 hertz, totally enclosed fan-cooled type.

F. Motors 1 HP and larger shall be three phase, 60 hertz, squirrel cage type, NEMA Design Code B (low current in-rush, normal starting torque), totally enclosed fan-cooled type.

G. Each contractor shall set all motors furnished by him.

H. All motors shall have a minimum service factor of 1.15.

I. All motors shall have ball or roller bearings with a minimum L-10 fatigue life of 150,000 hours in direct-coupled applications and 50,000 hours for belted applications. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG1-14.43.

J. Bearings shall be sealed type for 10 HP and smaller motors.

K. Motors for pumps 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70% when rated in accordance with DOE 10 CFR 431. These motors shall also have the means to adjust motor speed for either balancing or remote control.

2.2 PREMIUM EFFICIENCY MOTORS (INCLUDING MOST 3-PHASE GENERAL PURPOSE MOTORS)

A. All motors, unless exempted by EPAct legislation that became federal law on December 19, 2010, shall comply with the efficiencies listed in that standard, which are reprinted below. These match the 2010 NEMA premium efficiency ratings. All ratings listed are nominal full load efficiencies, verified in accordance with IEEE Standard 112, Test Method B. Average expected (not guaranteed minimum) power factors shall also be at least the following:

<table>
<thead>
<tr>
<th>HP</th>
<th>1200 rpm</th>
<th>1800 rpm</th>
<th>3600 rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>82.5</td>
<td>85.5</td>
<td>77.0</td>
</tr>
</tbody>
</table>

B. Motor nameplate shall be noted with the above ratings.

2.3 MOTOR DRIVEN EQUIPMENT

A. No equipment shall be selected or operate above 90% of its motor nameplate rating. Motor size may not be increased to compensate for equipment with efficiency lower than that specified.

B. If a larger motor than specified is required on equipment, the contractor supplying the equipment is responsible for all additional costs due to larger starters, wiring, etc.
PART 3 - EXECUTION

3.1 INSTALLATION

A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer’s recommendations. Align shafts to manufacturer’s requirements or within 0.002 inch per inch diameter of coupling hub.

END OF SECTION 22 05 13
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hangers, Supports, and Associated Anchors.
B. Equipment Bases and Supports.
C. Sleeves and Seals.
D. Flashing and Sealing of Equipment and Pipe Stacks.
E. Cutting of Openings.
F. Escutcheon Plates and Trim.

1.2 REFERENCES

B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.3 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 HANGER RODS

A. Hanger rods for single rod hangers shall conform to the following:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Hanger Rod Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; and smaller</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; through 3-5/8&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>4&quot; and 5&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>3/4&quot;</td>
</tr>
</tbody>
</table>

Column #1: Steel and cast iron pipe.
Column #2: Copper pipe.

B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.

C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2.2 PIPE AND STRUCTURAL SUPPORTS

A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, and 89.
2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.

a. Insulation Couplings:

1) Insulation Coupling: Molded thermoplastic, -65°F to 275°F, sizes up to 4-1/8” OD, and receive insulation thickness up to 1”. Suitable for use indoors or outdoors with UV stabilizers. Vertical insulation riser clamps shall have a 1,000lb454kg vertical load rating. On cold pipes operating below 60°F16°C, cover joint and coupling with vapor barrier mastic to ensure continuous vapor barrier.

2) Horizontal Strut Mounted Insulated Pipe:

a) Acceptable Manufacturers: Klo-Shure or equal.

3) Vertical:

a) Acceptable Manufacturers: Klo-Shure Titan or equal.

3. Copper piping located in an exposed area, including indirect waste piping in kitchens and janitor’s closets, shall use split ring standoff hangers for copper tubing. Support shall have copper electroplating for corrosion resistance. Use electro-galvanized or more corrosion resistant and threaded rod for floor applications. Use anchors applicable to the wall type with corrosion resistant threaded rod for wall applications.

Acceptable Products:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model/Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erico/M-Co</td>
<td>Model #456</td>
</tr>
<tr>
<td>B-Line</td>
<td>Fig. 3198HCT</td>
</tr>
<tr>
<td>Anvil</td>
<td>Fig. CT138R</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. 301CT</td>
</tr>
</tbody>
</table>

B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, unless otherwise noted by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.

Acceptable Products:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model/Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooper/B-Line</td>
<td>Fig B3373 Series</td>
</tr>
<tr>
<td>Erico</td>
<td>510 Series</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. 82</td>
</tr>
</tbody>
</table>

2. Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Select neoprene mounts based on the weight of the pipe to be supported. Insulate over mounts.

Acceptable Products: Mason RBA, RCA, or BR.
3. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs. Wall supports shall be coordinated with the Structural Engineer.

4. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

C. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.

2. Hangers in direct contact with copper pipe shall be coated with plastic with appropriate temperature range. Hydra-Zorb clamps are permitted for this application for bare pipes within their temperature limits of -65°F to +275°F.

3. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.

4. Ferrous hot piping 2-1/2 inches and larger shall have steel saddles tack welded to the pipe at each support with a depth not less than specified for the insulation. Factory fabricated inserts may be used.

   Acceptable Products:
   - Anvil - Fig. 160, 161, 162, 163, 164, 165
   - Cooper/B-Line - Fig. 3160, 3161, 3162, 3163, 3164, 3165
   - Erico - Model 630, 631, 632, 633, 634, 635
   - Nibco/Tolco - Fig. 260-1, 261-1 1/2, 262-2, 263-2 1/2, 264-3, 265-4

5. As an alternative to separate pipe insulation insert and saddle, properly sized integral rigid insulation sections may be used.

   Acceptable Products:
   - Cooper/B-Line - Fig. B3380 through B3384
   - Pipe Shields - A1000, A2000
   - Erico - Model 124, 127
6. Unless otherwise indicated, hangers shall be as follows:
   a. **Clevis Type:**
      
      **Service:**
      - Bare Metal Pipe
      - Insulated Cold Pipe
      - Insulated Hot Pipe - 3 inches & Smaller
      
      **Acceptable Products:**
      - Bare Steel, Plastic or Insulated Pipe
      - Bare Copper Pipe
      
      | Product       | Fig.     |
      |---------------|----------|
      | Anvil         | 260      |
      | Cooper/B-Line | 3100     |
      | Erico         | 400      |
      | Nibco/Tolco   | 1, 81PVC |

   b. **Continuous Channel with Clevis Type:**
      
      **Service:** Soft Copper Tubing
      
      **Acceptable Products:**
      - Cooper/B-Line - Fig. B3106, with Fig. B3106V
      - Erico - Model 104, with Model 104V
      - Nibco/Tolco - Fig. 1V

   c. **Adjustable Swivel Ring Type:**
      
      **Service:** Bare Metal Pipe - 4 inches and Smaller
      
      **Acceptable Products:**
      - Bare Steel Pipe
      - Bare Copper Pipe
      
      | Product       | Fig.     |
      |---------------|----------|
      | Anvil         | 69       |
      | Cooper/B-Line | B3170NF  |
      | Erico         | FCN      |
      | Nibco/Tolco   | 200, 203 |

7. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
   
   a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

8. Unless otherwise indicated, pipe supports for use with struts shall be as follows:
   a. **Clamp Type:**
      
      **Service:**
      - Bare Metal Pipe
      - Insulated Cold Pipe
      - Insulated Hot Pipe - 3 inches and smaller
      
      1) Clamps in direct contact with copper pipe shall be plastic coated.
2) Pipes subject to expansion and contraction shall have clamps oversized to allow limited pipe movement.

<table>
<thead>
<tr>
<th>Acceptable Products:</th>
<th>Bare Steel, Plastic or Insulated Pipe</th>
<th>Bare Copper Pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unistrut</td>
<td>Fig. P1100 or P2500</td>
<td></td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B2000 or B2400</td>
<td>Fig. BVT</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. A-14 or 2STR</td>
<td></td>
</tr>
</tbody>
</table>

b. **Roller Type:**

Service: Insulated Hot Pipe - 4 inches and larger.

<table>
<thead>
<tr>
<th>Acceptable Products:</th>
<th>4&quot; through 6&quot;</th>
<th>8&quot; and Above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unistrut</td>
<td>Fig. P2474</td>
<td>Fig. P2474-1</td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B218</td>
<td>Fig. B219</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. ROL-12</td>
<td>Fig. ROL-13</td>
</tr>
</tbody>
</table>

D. **Upper (Structural) Attachments:**

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

2. **Steel Structure Clamps**

a. **C-Type Wide Flange Beam Clamps** (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists):

<table>
<thead>
<tr>
<th>Acceptable Products:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Anvil</td>
<td>Fig. 92</td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B3033/B3034</td>
</tr>
<tr>
<td>Erico</td>
<td>Model 300</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>68</td>
</tr>
</tbody>
</table>

b. **Scissor Type Beam Clamps** (For use with bar-joists and wide flange):

<table>
<thead>
<tr>
<th>Acceptable Products:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Anvil</td>
<td>Fig. 228, 292</td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B3054</td>
</tr>
<tr>
<td>Erico</td>
<td>Model 360</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. 329</td>
</tr>
</tbody>
</table>

3. **Concrete**

a. **Concrete Inserts, Single Rod Galvanized:**

<table>
<thead>
<tr>
<th>Acceptable Products:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Anvil</td>
<td>Fig. 282</td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B3014</td>
</tr>
<tr>
<td>Erico</td>
<td>Model 355</td>
</tr>
<tr>
<td>Nibco/Tolco</td>
<td>Fig. 310</td>
</tr>
</tbody>
</table>
b. Concrete Inserts, Continuous Strip Galvanized:

Acceptable Products:

<table>
<thead>
<tr>
<th>Company</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unistrut Corp</td>
<td>P3200 Series</td>
</tr>
<tr>
<td>Cooper/B-Line</td>
<td>Fig. B22-J</td>
</tr>
<tr>
<td>Erico</td>
<td>CONCT</td>
</tr>
</tbody>
</table>

c. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

4. Steel Structure Welding:

a. Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and protecting walls and ceilings from smoke damage.

2.3 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.

2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

B. Concrete Bases (Housekeeping Pads):

1. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base).

2. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a “dirt-trap”.

3. Concrete materials and workmanship required for the Contractor's work shall be provided by him. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6"x6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days.

4. Equipment requiring bases is as follows:

   a. Water Heater

C. Supports:

1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

D. Grout:

1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.

2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.

3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

2.4 OPENINGS IN FLOORS, WALLS AND CEILINGS

A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.

B. Coordinate all openings with other Contractors.

C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.

D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at his expense.

E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.5 ROOF PENETRATIONS

A. Seal pipes with surface temperature below 150ºF penetrating single-ply roofs with conical stepped pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots. Material shall match roofing membrane.

B. Break insulation only at the clamp for pipes between 60ºF and 150ºF. Seal outdoor insulation edges watertight.

2.6 SLEEVES AND LINTELS

A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.

B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.

C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.
D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.

E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Architect/Engineer’s design.

F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.

G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.

H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.

I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

2.7 ESCUTCHEON PLATES AND TRIM

A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.

B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.

C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

2.8 PIPE PENETRATIONS

A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.

B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.9 PIPE ANCHORS

A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.

B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.10 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
PART 3 - EXECUTION

3.1 PLUMBING SUPPORTS AND ANCHORS

A. General Installation Requirements:
   1. Install all items per manufacturer's instructions.
   2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
   3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

B. Supports Requirements:
   1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
   2. Set all concrete inserts in place before pouring concrete.
   3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
   4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
   5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:
   1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
   2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
   3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
   4. Piping shall not introduce strains or distortion to connected equipment.
   5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
   6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
   7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3’ spacing between loads.

2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:
   a. The hanger is attached within 6” from a web/chord joint.
   b. Additional L2x2x1/4 web reinforcement is installed per manufacturer’s requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.

4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4” below bottom face of lowest fastener and blunt any sharp edges.

F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0” on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0” spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

G. Do not exceed the manufacturer’s recommended maximum load for any hanger or support.

H. Spacing of Hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

<table>
<thead>
<tr>
<th>Pipe Material</th>
<th>Maximum Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Steel (Std. Weight or Heavier – Liquid Service):</td>
<td></td>
</tr>
<tr>
<td>1-1/4&quot; &amp; under</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>2&quot;</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>2-1/2&quot;</td>
<td>11'-0&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>4&quot; &amp; larger</td>
<td>12'-0&quot;</td>
</tr>
</tbody>
</table>

<p>| 2. Steel (Std. Weight or Heavier – Vapor Service): | |
| 1-1/4&quot; and under                | 9'-0&quot;          |
| 1-1/2&quot;                          | 12'-0&quot;         |
| 2&quot; &amp; larger                     | 12'-0&quot;         |</p>
<table>
<thead>
<tr>
<th>Pipe Material</th>
<th>Maximum Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Drawn Copper &amp; Brass (Liquid Service):</td>
<td></td>
</tr>
<tr>
<td>3/4&quot; and under</td>
<td>5'-0&quot;</td>
</tr>
<tr>
<td>1&quot;</td>
<td>6'-0&quot;</td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>8'-0&quot;</td>
</tr>
<tr>
<td>2&quot;</td>
<td>8'-0&quot;</td>
</tr>
<tr>
<td>2-1/2&quot;</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>4&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>Hard Drawn Copper &amp; Brass (Vapor Service):</td>
<td></td>
</tr>
<tr>
<td>3/4&quot; &amp; under</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>1&quot;</td>
<td>8'-0&quot;</td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>2&quot;</td>
<td>11'-0&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; &amp; larger</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>Soft Copper Tubing:</td>
<td></td>
</tr>
<tr>
<td>a. Continuous channel with hangers maximum 8'-0&quot; OC.</td>
<td></td>
</tr>
<tr>
<td>6. Installation of hangers shall conform to MSS SP-58, 69, 89 and the applicable Plumbing Code.</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION 22 05 29
SECTION 22 05 53
PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Identification of products installed under Division 22.

1.2 REFERENCES
B. ASTM B-1, B-3, and B-8 for copper conductors.
C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 – 2kV Cables.
D. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

2.2 MATERIALS
A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

<table>
<thead>
<tr>
<th>OD of Pipe or insulation</th>
<th>Marker Length</th>
<th>Size of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to and including 1-1/4&quot;</td>
<td>8&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>1-1/2&quot; to 2&quot;</td>
<td>8&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>2-1/2&quot; to 6&quot;</td>
<td>12&quot;</td>
<td>1-1/4&quot;</td>
</tr>
</tbody>
</table>

Plastic tags may be used for outside diameters under 3/4".

B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.

C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.

D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.

E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.

F. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all products per manufacturer’s recommendations.

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Valves:
   1. All valves (except shutoff valves at equipment) shall have numbered tags.
   2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
   3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
   4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
   5. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.
   6. Number all tags and show the service of the pipe.
   7. Provide two sets of laminated 8-1/2" x 11" copies of a valve directory listing all valves, with respective tag numbers, uses, and locations. The directory shall be reviewed by the Owner and Architect/Engineer prior to laminating final copies. Laminated copies shall have brass eyelet in at least one corner for easy hanging.

D. Pipe Markers:
   1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
   2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
   3. Apply markers and arrows in the following locations where clearly visible:
      a. At each valve.
      b. On both sides of walls that pipes penetrate.
      c. At least every 20 feet along all pipes.
      d. On each riser and each leg of each "T" joint.
      e. At least once in every room and each story traversed.
October 15, 2019

4. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.

E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.

2. Provide engraved plastic tags at all hydronic makeup water meters.

3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

3.2 SCHEDULE

A. Pipes to be marked shall be labeled with the text as shown in the following table regardless of which method or material is used:

<table>
<thead>
<tr>
<th>Pipe Service</th>
<th>Lettering Color</th>
<th>Background Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONDENSATE DRAIN</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>COMPRESSED AIR</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>DOMESTIC COLD WATER</td>
<td>White</td>
<td>Green</td>
</tr>
<tr>
<td>DOMESTIC HOT WATER - 115°F</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>DOMESTIC HOT WATER - 140°F</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>DOMESTIC HOT WATER CIRCULATING - 115°F</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>SANITARY SEWER</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>VENT</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>STORM SEWER (PRIMARY AND SECONDARY)</td>
<td>White</td>
<td>Green</td>
</tr>
<tr>
<td>NATURAL GAS</td>
<td>Black</td>
<td>Yellow</td>
</tr>
<tr>
<td>All Underground Pipes</td>
<td>Varies</td>
<td>Varies</td>
</tr>
</tbody>
</table>

END OF SECTION 22 05 53
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping Insulation.
B. Insulation Jackets.

1.2 QUALITY ASSURANCE

A. Applicator: Company specializing in piping insulation application with five years minimum experience.
B. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723 (where required).

1.3 REFERENCES

B. ANSI/ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
C. ANSI/ASTM C534 - Elastomeric Foam Insulation.
D. ASTM C591 - Unfaced Preformed Rigid Cellular Polyisocyanurate Insulation.
I. UL 723 - Surface Burning Characteristics of Building Materials.

PART 2 - PRODUCTS

2.1 INSULATION

A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible. All purpose, white Kraft jacket bonded to aluminum foil and reinforced with fiberglass yarn, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723).

B. Type B: EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°F, 25/50 flame spread/smoke
developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1” thick per layer where multiple layers are specified.

C. Type C: Molded rigid cellular glass; ANSI/ASTM C-552; 0.35 maximum ‘K’ value at 75ºF; moisture resistant, non-combustible; suitable for -100ºF to +900ºF. For below grade installations use asphaltic mastic paper vapor barrier jacket. Use self-seal all-purpose white Kraft jacket for above grade installations.

D. Type D: Hydrous Calcium Silicate; ASTM C533; rigid molded pipe insulation; asbestos free; 0.40 ‘K’ value at 300ºF; 1200ºF maximum service temperature; 16 gauge stainless steel tie wires on maximum 12” centers.

2.2 VAPOR BARRIER JACKETS


PART 3 - EXECUTION

3.1 PREPARATION

A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

3.2 INSTALLATION

A. General Installation Requirements:

1. Install materials per manufacturer’s instructions, building codes and industry standards.

2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.

3. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a 180° cylindrical segment the same length as metal shields. Inserts shall be a cellular glass (for all temperature ranges) or molded hydrous calcium silicate (for pipe with operating temperatures above 70ºF), with a minimum compressive strength of 50 psi. Factory fabricated inserts may be used. Rectangular blocks, plugs, or wood material are not acceptable. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.

4. Neatly finish insulation at supports, protrusions, and interruptions.

5. Install metal shields between all hangers or supports and the pipe insulation. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation as required to maintain the vapor barrier, or add separate vapor barrier jacket.
6. Shields shall be at least the following lengths and gauges:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Shield Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 1/2&quot; to 3-1/2&quot;</td>
<td>12&quot; long x 18 gauge</td>
</tr>
<tr>
<td>b. 4&quot;</td>
<td>12&quot; long x 16 gauge</td>
</tr>
<tr>
<td>c. 5&quot; to 6&quot;</td>
<td>18&quot; long x 16 gauge</td>
</tr>
</tbody>
</table>

7. All piping and insulation that does not meet 25/50 that is in an air plenum shall have written approval from the Authority Having Jurisdiction and the local fire department for authorization and materials approval. If approval has been allowed, the non-rated material shall be wrapped with a product that has passed ASTM E84 and/or NFPA 255 testing with a rating of 25/50 or below.

8. On 1" and smaller piping routed through metal wall studs, provide a plastic grommet to protect the piping. The piping shall be insulated between the wall studs, and the insulation shall butt up to each stud.

B. Insulated Piping Operating Below 60°F:

1. Insulate fittings, valves, unions, flanges, strainers, flexible connections, flexible hoses, and expansion joints. Seal all penetrations of vapor barrier.

2. On piping operating below 60°F in locations that are not mechanically cooled (e.g., penthouses, mechanical rooms, tunnels, chases at exterior walls, etc.), Type B insulation shall be used.

3. All balance valves with fluid operating below 60°F shall be insulated with a removable plug wrapped with vapor barrier tape to allow reading and adjusting of the valve.

C. Insulated Piping Operating Between 60°F and 140°F:

1. Do not insulate flanges and unions, but bevel and seal ends of insulation at such locations. Insulate all fittings, valves and strainers.

D. Insulated Piping Operating Above 140°F:

1. Insulate fittings, valves, flanges, and strainers.

2. All balance valves with fluid operating above 140°F shall be insulated and an opening shall be left in the insulation to allow for reading and adjusting the valve.

E. Exposed Piping:

1. Locate and cover seams in least visible locations.

2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.

3. On exposed piping serving kitchen equipment or plumbing fixtures, the piping does not need to be insulated if less than four feet in developed length. If piping is longer than four feet in developed length, the piping shall be insulated and have a plastic jacket.
3.3 **INSULATION**

**A. Type A Insulation:**
1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.

2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.

3. Apply insulation with laps on top of pipe.

4. Fittings, Valve Bodies and Flanges: For 4” and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4”, use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2” on itself. For pipes operating below 60°F, seal fitting covers with vapor retarder mastic in addition to tape.

**B. Type B Insulation:**
1. Elastomeric Cellular Foam: Where possible, slip insulation over the open end of pipe without slitting. Seal all butt ends, longitudinal seams, and fittings with adhesive. At elbows and tees, use mitered connections. Do not compress or crush insulation at cemented joints. Joints shall be sealed completely and not pucker or wrinkle. Paint the outside of outdoor insulation with two coats of latex enamel paint recommended by the manufacturer.

2. Self-seal insulation may be used on pipes operating below 170°F.

**C. Type C Insulation:**
1. Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner.

2. Insulate fittings with prefabricated fittings.

**D. Type D Insulation:**
1. Use pre-molded half sections. Butt longitudinal and circumferential joints tightly. Wire in place with 16 gauge stainless steel wire on maximum 12" centers.

2. Apply in two layers. Stagger all joints between layers. Wire each layer individually.

3. Insulate pipe fittings with prefabricated insulation fittings.

3.4 **JACKET COVER INSTALLATION**

**A. Plastic Covering:**
1. Provide vapor barrier as specified for insulation type. Cover with plastic jacket covering. Position seams to shed water.

2. Solvent weld all joints with manufacturer recommended cement.
3. Overlap all laps and butt joints 1-1/2" minimum. Repair any loose ends that do not seal securely. Solvent weld all fitting covers in the same manner. Final installation shall be watertight.

4. Use plastic insulation covering on all exposed pipes including, but not limited to:
   a. All exposed piping below 8'-0" above floor.

5. Elastomeric piping insulation may have two coats of latex paint instead of plastic jacket.

3.5 SCHEDULE

<table>
<thead>
<tr>
<th>Piping System</th>
<th>Insulation Type/Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Domestic Hot Water &amp; Circulating - Potable and Non-Potable - up to 140°F</td>
<td></td>
</tr>
<tr>
<td>Up to 1-1/2&quot; Pipe Size</td>
<td>A / 1&quot;</td>
</tr>
<tr>
<td>Above 1-1/2&quot; Pipe Size</td>
<td>A / 1-1/2&quot;</td>
</tr>
<tr>
<td>B. Domestic Hot Water &amp; Circulating - Potable and Non-Potable - over 140°F</td>
<td></td>
</tr>
<tr>
<td>Up to 1-1/2&quot; Pipe Size</td>
<td>A / 1&quot;</td>
</tr>
<tr>
<td>Above 1-1/2&quot; Pipe Size</td>
<td>A / 1-1/2&quot;</td>
</tr>
<tr>
<td>C. Domestic Cold Water - Potable and Non-Potable</td>
<td>A / 1&quot;</td>
</tr>
<tr>
<td>D. Storm Drainage (include drain bodies and all piping within the building, except underground)</td>
<td>A / 1&quot;</td>
</tr>
<tr>
<td>E. Plumbing Vents Within 10' from Roof Penetration</td>
<td>A / 1/2&quot;</td>
</tr>
<tr>
<td>F. Cooling Coil Condensate Drains &amp; Dedicated Floor Drain Branch Piping, Sanitary and Indirect Waste Piping Conveying Fluids below 55°F</td>
<td>B / 1/2&quot;</td>
</tr>
<tr>
<td>G. Above Grade Drains at Ice Machines (include drain bodies, P-trap, and 10' of downstream drain piping)</td>
<td>A / 1&quot;</td>
</tr>
<tr>
<td>H. Insulation Inserts at hangers</td>
<td>C or D - Match pipe insulation thickness</td>
</tr>
</tbody>
</table>

END OF SECTION 22 07 19
SECTION 22 09 00
INSTRUMENTATION

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Pressure Gauge.
   B. Pressure Gauge Accessories.
   C. Thermometers.

1.2 REFERENCES
   A. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES
   A. Gauges shall be 4-1/2" diameter with aluminum or stainless steel case with phosphor bronze bourdon tube, brass socket for water or oil application, 1/4" or 1/2" bottom connection. Gauges shall be 1% full scale accurate with bronze bushed brass movement and adjustable pointer. Standard ranges to be either pressure or pressure and vacuum as required of application.
   B. Acceptable Manufacturers: Ashcroft, Marsh, Marshalltown, Miljoco, Trerice, U.S. Gauge Figure 1901, Weiss, Weksler, Wika.
   C. Select gauge range for normal reading near center of gauge.

2.2 PRESSURE GAUGE ACCESSORIES
   A. All pressure gauges shall have valves and pressure snubbers.
   B. Shutoff Valve: 1/4" ball valve as specified for each piping system.
   C. Pressure snubber, brass with 1/4" connections, porous metal type.

2.3 THERMOMETERS
   A. Dial Type:
      1. 4-1/2" diameter, hermetically sealed case. Stainless steel case and stem. Accuracy of 1% full scale with external recalibrator.
      2. Select thermometers for appropriate temperature range. Adjustable elbow joint with locking device to allow rotation of thermometer to any angle.
      3. Stem lengths as required for application with minimum insertion of 2-1/2".
4. Thermometers for water shall have brass or steel separable socket. Thermometer wells shall be stainless steel, pressure rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.


B. Select scales to cover expected range of temperatures.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Install per manufacturer’s instructions.

2. Coil and conceal excess capillary on remote element instruments.

3. Install gauges and thermometers in locations where they are easily read from normal operating level.

4. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

B. Pressure Gauges:

1. Connect pressure gauges to suction and discharge side of all pumps.

2. Provide snubber for each pressure gauge.

C. Thermometers:

1. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2” for installation of thermometer sockets.

2. Install thermometer sockets adjacent to control system thermostat, transmitter and sensor sockets.

END OF SECTION 22 09 00
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and Pipe Fittings.
B. Valves.
C. Domestic Water Piping System.
D. Compressed Air Piping System (Non-Medical).
E. Sanitary Drainage and Vent Piping System.
F. Storm Drainage Piping System.

1.2 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.
D. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

1.3 REFERENCES

A. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
B. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
D. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
E. ANSI/ASTM B32 - Solder Metal.
G. ASME - Boiler and Pressure Vessel Code.
I. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
K. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
M. ASTM B88 - Seamless Copper Water Tube.
N. ASTM B306 - Copper Drainage Tube (DWV).
Q. AWS A5.8 - Brazed Filler Metal.
R. AWWA C651 - Disinfecting Water Mains.
V. NFPA 24 - Private Fire Service Mains and Their Appurtenances.

1.4 DELIVERY, STORAGE, AND HANDLING
A. Deliver and store valves in shipping containers with labeling in place.

1.5 COORDINATION DRAWINGS
A. Reference Coordination Drawings article in Section 22 05 00 for required plumbing systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

PART 2 - PRODUCTS

2.1 COLD WATER - POTABLE AND NON-POTABLE
HOT WATER - POTABLE AND NON-POTABLE
A. Design Pressure: 175 psi.
   Maximum Design Temperature: 200°F.
B. Piping - All Sizes:
   1. Tubing: Type L hard drawn seamless copper tube, ASTM B88.
   2. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
C. Piping - 4" and Under (Contractor's Option):
   1. Tubing: Type L hard drawn seamless copper tube, ASTM B88.

D. Shutoff Valves:

1. For pipe systems where mechanical press connections are allowed, shutoff valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.

2. Ball Valves:
   a. BA-1:
      1) 3" and under, 150 psi saturated steam, 600 psi CWP, full port, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals. Apollo #77C-140, Stockham #S-255-FB-P-UL BR1-R, Milwaukee #BA-400, Watts, Nibco #585-70-66, National Utilities Co., RUB.

NOTES:
   a) Provide extended shaft for all valves in insulated piping.
   b) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

E. Throttling/Shutoff Valves:

1. For pipe systems where mechanical press connections are allowed, throttling valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.

2. Globe Valves:
   a. GL-1: 2" and under, 150# saturated steam, 300# CWP, screwed, bronze. Crane #7TF, Stockham #B22T, Walworth #3095, Milwaukee #590, Hammond #IB413T, Watts #B-4010-T, Nibco T-235Y.
   b. GL-2: 2-1/2" thru 10", 125# steam @ 353°F, 200# CWP @ 150°F, flanged, iron body, bronze mounted. Crane #351, Hammond #IR116, Stockham #G-512, Walworth #8906F, Milwaukee #F2981, Watts #F-501, Nibco F-718B.

F. Check Valves:

1. For pipe systems where mechanical press connections are allowed, check valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
2. CK-1: 2" and under, 125# steam @ 406°F, 200# CWP @ 150°F, screwed, bronze, horizontal swing. Crane #37, Hammond #IB904, Stockham #B319-Y, Walworth #3406, Milwaukee #509, Watts #G-5000, Nibco T-413B.

G. Strainers:

1. For pipe systems where mechanical press connections are allowed, strainers with mechanical press connections are acceptable subject to the requirements in the paragraphs below.

2. ST-1: Bronze body, screwed ends, screwed cover, 150 psi S @ 350°F, 200 psi CWP @ 150°F. Armstrong #F4SC, Metraflex #TS, Mueller Steam Specialty Co. #351, Sarco #BT, Watts #777.

2.2 COMBINATION WATER AND FIRE PROTECTION SERVICE

A. Design Pressure: 200 psi.

Maximum Design Temperature: 150°F.


B. Piping:


2.3 COMPRESSED AIR

A. Parker Transair:

1. Design Pressure: 188 psi

Maximum Design Temperature: 140°F

2. Piping system shall be full-bore passage without diameter restriction for fittings.
3. Piping – 2-1/2" and Under:
   b. Connectors:
      1) 1-1/2" and Under: Instant-to-connect, gripping ring technology, half-turn release mechanism. PA 6.6 or PA 12 +30% fiberglass reinforced engineering grade plastic with stainless steel gripping teeth, Nitrile IRHD50 seals. Male stud couplings and wall brackets shall be black, nickel-plated brass.
      2) 2-1/2": Instant-to-connect, double-clamp ring technology, threaded release mechanism. Black cataphoresis aluminum AS9U3 body and clamp ring, Nitrile IRHD70 seals. Male stud couplings and wall brackets shall be black, nickel-plated brass.

4. If pipe size shown on drawings is not available, the next larger size pipe shall be provided unless approval is granted from Engineer.

5. Shut-Off Valves:
   a. Ball Valves:
      1) 2-1/2" and Under: 185 psi @ 140°F. PA 6.6 or PA 12 +30% fiberglass reinforced engineering grade quick-connect plastic connections. Brass body with stainless steel disc and shaft.

6. Strainers:
   a. ST-2: Cast iron body, 125 lb. flanged ends, bolted cover, 125 psi S @ 350°F, 175 psi CWP @ 150°F. Armstrong #A1FL, Metraflex #TF, Mueller Steam Specialty Co. #751, Sarco #CI-125, Watts #77F-D.
   b. ST-4: Cast iron body, screwed ends, screwed cover, 250# steam @ 406°F, 300# CWP @ 150°F. Armstrong #A1SC, Metraflex #SM, Mueller Steam Specialty Co. #11, Sarco #IT.

2.4 SANITARY DRAINAGE (ABOVE GROUND)
SANITARY VENT (ABOVE GROUND)
STORM DRAINAGE (ABOVE GROUND)
CONDENSATE DRAINAGE (ABOVE GROUND)

A. Design Pressure: Gravity
   Maximum Design Temperature: 180°F

B. Piping - All Sizes:
   1. Pipe and Fittings: Standard weight hub and spigot cast iron soil pipe, corrosion protective coating inside and outside, ASTM A74, NSF Certified, CiSPI Trademark.
   2. Joints: Compression gasket, ASTM C564 or lead and oakum, ASTM B29.
3. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

C. Piping - 1-1/2" through 15":

1. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888, NSF certified, CISPI trademark.

2. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888.

3. Joints: Heavy duty, neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.

4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

D. Piping - 1-1/4" through 4":

1. Pipe: Type M hard temper seamless copper drainage tube, ASTM B306.

2. Joints: Solder with 100% lead-free solder and flux, ASTM B32.

3. Fittings: Cast brass solder joint drainage type, ANSI B16.23 or wrought copper solder joint drainage type, ANSI B16.29.

E. Vent Flashing: Flash vents with premolded EPDM pipe flashing cones for single-ply membrane roofs.

2.5 SANITARY DRAINAGE (BELOW GROUND - INSIDE BUILDING)
SANITARY VENT (BELOW GROUND - INSIDE BUILDING)
STORM DRAINAGE (BELOW GROUND - INSIDE BUILDING)

A. Design Pressure: Gravity
Maximum Design Temperature: 180°F

B. Piping - All Sizes:

1. Pipe and Fittings: Standard weight hub and spigot cast iron soil pipe, corrosion protective coating inside and outside, ASTM A74, NSF certified, CISPI trademark.

2. Pipe and Fittings: Standard weight hub and spigot cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888.

4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

C. Piping - 1-1/2" through 15":
1. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888, NSF certified, CISPI trademark.
2. Pipe and Fittings: Standard weight no-hub cast iron soil pipe, corrosion protective coating inside and outside, CISPI 301 or ASTM A888.
3. Joints: Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with at least four screw type clamps, FM 1680 or ASTM C1540.
4. Adapters: Transitions from cast iron soil pipe to other pipe materials with manufactured adapters. Heavy duty neoprene sleeve gasket, ASTM C-564, 300 Series stainless steel shield, clamp, and screws with not less than four screw type clamps, FM 1680 or ASTM C1540.

2.6 LOCK OUT TRIM
A. Provide lock out trim for all quarter turn shutoff valves opening to atmosphere and installed in domestic water piping over 120°F, in compressed air piping, and as indicated on the drawings.

2.7 VALVE OPERATORS
A. Provide handwheels for gate valves and gear operators for butterfly valves.

2.8 VALVE CONNECTIONS
A. Provide all connections to match pipe joints. Valves shall be same size as pipe unless noted otherwise.

PART 3 - EXECUTION
3.1 PREPARATION
A. Install all products per manufacturer’s recommendations.
B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
C. Remove scale and dirt, on inside and outside, before assembly.
D. Connect to equipment with flanges or unions.
E. Use only piping materials rated for the maximum temperature of the application, e.g., do not use PVC for dishwasher drainage.
3.2 TESTING PIPING

A. Sanitary Drainage:
   Sanitary Vent:
   Storm Drainage:

   1. Test all piping with water to prove tight.
   2. Test piping before insulation is applied.
   3. Hydrostatically test all soil, waste, and vent piping inside of building with 10 feet head of water for 15 minutes. Inspect before fixtures are connected. If leaks appear, repair them and repeat the test.
   4. Hydrostatically test interior downspouts with 10 feet head of water for 15 minutes with no leaks.
   5. A smoke/air test at the same pressure may be used in lieu of the hydrostatic water test. Exception: Smoke/air test shall not be performed on plastic piping.
   6. Test force mains with water at 105% of the operating pump discharge pressure for 15 minutes.
   7. Test pressures stated above shall be as listed or as required by the Authority Having Jurisdiction, whichever is most stringent.

B. Hot Water - Potable and Non-Potable:
   Cold Water - Potable and Non-Potable:
   Service Water:

   1. Test pipes underground or in chases and walls before piping is concealed.
   2. Test all pipes before the insulation is applied. If insulation is applied before the pipe is tested and a leak develops which ruins the insulation, replace damaged insulation.
   3. Test the pipe with 100 psig water pressure or equal inert gas such as nitrogen.
   4. Hold test pressure for at least 2 hours.
   5. Test to be witnessed by the Architect/Engineer's representative, if requested by the Architect/Engineer.

C. Fire Service:

   1. Hydrostatically test the entire system for two hours at 200 psig. Maximum leakage shall be:

   a. Interior Piping: 0 quarts per hour.
   b. Underground Piping: 2 quarts per 100 joints per hour.
D. All Other Piping:

1. Test piping at 150% of normal operating pressure.
2. Piping shall hold this pressure for one hour with no drop in pressure.
3. Test piping using water, nitrogen, or air as compatible with the final service of the pipe. Do not use combustible fluids.
4. Drain and clean all piping after testing is complete.

3.3 CLEANING PIPING

A. Assembly:

1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
3. Notify the Architect/Engineer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.

B. Air Blow:

1. Blow out pipe and components with clean compressed air. Instrument air, argon, nitrogen and sulfuric acid lines shall be blown out with dry, oil free air or nitrogen gas. "Oil Free" is defined as air compressed in a centrifugal, Teflon ring, carbon ring or water pumped air compressor. Where air supply is judged to be inadequate to continually attain cleaning velocity, alternate pressurization and sudden relief procedure may be used until discharge at all blow out points is clean. Use 80-90 psig pressure unless otherwise indicated.
2. Air blow applies to the following systems:
   a. Air Compressor Intakes

C. All Water Piping:

1. Flush all piping using faucets, flush valves, etc. until the flow is clean.
2. After flushing, thoroughly clean all inlet strainers, aerators, and other such devices.
3. If necessary, remove valves to clean out all foreign material.
D. Fire Service:

1. Flush all underground piping with minimum flow equal to the system design flow but not less than the following:
   a. 390 gpm for 4” pipes.
   b. 880 gpm for 6” pipes.

3.4 INSTALLATION

A. General Installation Requirements:

1. Provide dielectric connections between dissimilar metals.
2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
3. Group piping whenever practical at common elevations.
4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
5. Slope water piping and arrange to drain at low points.
6. Install bell and spigot piping with bells upstream.
7. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
8. Seal pipes passing through exterior walls with a wall seal per Section 22 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
9. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8” high lettering saying “Non-Potable Water Not for Human Consumption.” Sign shall have black lettering on a yellow background.
10. All vertical pipe drops to sinks or other equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted.

B. Installation Requirements in Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.

C. Valves/Fittings and Accessories:

1. Install shutoff valves that permit the isolation of equipment/fixtures in each room without isolating any other room or portion of the building. Individual fixture angle stops do not meet this requirement. Exception: Back-to-back rooms in no more than two adjacent rooms.
2. Provide clearance for installation of insulation and access to valves and fittings.
3. Provide access doors for concealed valves and fittings.

4. Install valve stems upright or horizontal, not inverted.

D. Underground Piping:

1. Install buried water piping outside the building with at least 5 feet of cover.

2. Underground fire protection service piping shall have at least 6-1/2 feet of cover, or as recommended by NFPA 24, whichever is greater.

3. Install thrust blocking and restraints on all underground fire protection service piping per NFPA 24 and as shown on drawings.

4. Lay all underground piping in trenches. Provide and operate pumping equipment to keep trenches free of water.

5. For all underground piping, provide a foundation (the layer below the bedding) if the trench bottom is unstable. When the trench is in rock, lay underground metallic piping on 6” of sand bedding. Provide recessed areas for pipe bells and joints. After joints are made, any misalignment in elevation shall be corrected by tamping sand around the pipe. Backfill with sand in uniform layers not over 6” deep to the spring line of all underground pipes, and carefully compact each layer to 90 percent Standard Proctor density. Backfill with sand up to 6” above pipe for landscaped areas. Remaining backfill may be soil. Under paving and buildings, the remaining backfill shall be sand and compacted to 98 percent Standard Proctor density.

6. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.

7. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.

8. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Architect/Engineer's representative with an electronic holiday detector. Any defects in the protective coatings shall be repaired in accordance with requirements for original coatings.

9. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.

E. Sanitary and Storm Piping:

1. Install all sanitary piping inside the building with a slope of at least the following:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Minimum Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>3” and under</td>
<td>- 0.25” per foot</td>
</tr>
<tr>
<td>4” and over</td>
<td>- 0.125” per foot</td>
</tr>
</tbody>
</table>

   a. All sanitary systems transporting grease laden waste shall be sloped a minimum of 0.25” per foot regardless of size.
2. Install all storm piping inside the building with a slope of at least 0.125" per foot unless noted otherwise.

3. Install horizontal offset at all connections to roof drains to allow for pipe expansion.

4. Slope sanitary and storm piping outside the building to meet invert elevations shown on drawings and to maintain a minimum velocity of 3 feet per second.

5. All sanitary and storm piping shall have at least 42" of cover when leaving the building.

3.5 PIPE ERECTION AND LAYING

A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.

B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.

C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.

D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.

E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.

F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.

G. Provide flanges or unions at all final connections to equipment, traps and valves.

H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.

I. Use full and double lengths of pipe wherever possible.

J. Unless otherwise indicated, install all piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or equipment.

K. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.
L. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Provide and operate sufficient pumping equipment to maintain excavations, trenches and pits free of water. Dispose of pumped water so operation areas and other facilities are not flooded. Pipe laying shall follow excavating as closely as possible.

M. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45° or 90° angle from the horizontal plane for air lines, and from top, bottom or side for liquids.

3.6 DRAINING AND VENTING

A. Unless otherwise indicated on the drawings, all horizontal water and compressed air lines, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate and venting.

B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.

C. Provide drain valves at all low points of water piping systems for complete or sectionalized draining.

D. Provide drip legs at low points and at the base of all risers in compressed air pipes. Drip legs shall be full line size on pipes through 4" and at least 4", but not less than half line size over 4". Drip legs shall be 12" minimum length, capped with a reducer to a drain valve.

E. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install compressed air and gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.

F. Provide air vents at high points and wherever else required to eliminate air in all water piping systems.

G. Install air vents in accessible locations. If necessary to trap and vent air in a remote location, install an 1/8" pipe from the tapping location to an accessible location and terminate with a venting device.

H. All vent and drain piping shall be of same materials and construction for the service involved.

3.7 PLUMBING VENTS

A. Vent as shown on the drawings and in accordance with all codes having jurisdiction.

B. Extend the high side of the soil and waste stacks at least 12" above roof.

C. Flash pipes at roof with premolded EPDM pipe flashing cones adhered to roof membrane by General Contractor. Secure top of cone with stainless steel clamp and seal watertight.

D. Increase vent pipes through the roof two pipe sizes with long increasers located at least 12" below the roof.

E. In no case shall the vent through the roof be less than 4" in diameter.
F. Vent pipes through the roof shall be located a minimum of 15 feet from any air intake or exhaust opening on the roof.

3.8 BRANCH CONNECTIONS

A. For domestic water and vent systems only, make branch connections with standard tee or cross fittings of the type required for the service.

B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.

C. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.

D. Branch connections from the headers and mains may be mechanically formed using an extraction device. The branch piping connection shall be brazed connection for the following services only:
   1. Domestic water piping above grade.

E. Further limit use of mechanically formed fittings as follows:
   1. Must have at least same pressure rating as the main.
   2. Main must be type K or L copper tubing.
   3. Permanent marking shall indicate insertion depth and orientation.
   4. Branch pipe shall conform to the inner curve of the piping main.
   5. Main must be 1" or larger.
   6. Branch must be 3/4" or larger.

F. Branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.

G. Forged weld-on fittings are limited as follows:
   1. Must have at least same pressure rating as the main.
   2. Main must be 2-1/2" or larger.
   3. Branch line is at least two pipe sizes under main size.

3.9 JOINING OF PIPE

A. Threaded Joints:
   1. Threads shall conform to ANSI B2.1 "Pipe Threads".
   2. Ream pipe ends and remove all burrs and chips formed in cutting and threading.
   3. Protect plated pipe and valve bodies from wrench marks when making up joints.
4. Apply thread lubricant to male threads as follows:

   Vents and Roof Conductors: Red graphite
   All Other Services: PTFE tape

B. Flanged Joints:

1. Steel pipe flanges shall conform to ANSI B16.5 "Steel Pipe Flanges and Flanged Fittings". Cast iron pipe flanges shall conform to ANSI B16.1 "Cast Iron Flanged and Flanged Fittings". Steel flanges shall be raised face except when bolted to flat face cast iron flange.

2. Bolting for services up to 500°F shall be ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts".

3. Set flange bolts beyond finger tightness with a torque wrench for equal tension in all bolts. Tighten bolts so those 180° apart are torqued in sequence.

4. Gaskets for flat face flanges shall be full face type. Gaskets for raised faced flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Unless otherwise specified gaskets shall meet the following requirements:
   a. Gasket material and thickness approved by manufacturer for intended service, chemical compatibility, pipe system test pressure, and operating temperature range.
   b. Maximum pressure rating of at least 250 psig.
   c. Minimum temperature rating: -10°F.
   d. Maximum temperature rating of at least 170°F for water systems operating 140°F and less.

C. Solder Joints:

1. Make up joints with 100% lead-free solder, ASTM B32. Cut tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.

2. Flux shall be non-acid type.

3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470°F melting point solder. Remove discs and seals during soldering if they are not suitable for 470°F.

D. Brazed Joints:

1. Make up joints with silver alloy brazing filler metal conforming to ASTM B260 "Brazing Filler Metal" BAg-1 or BAg-2. Cut copper tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to brazing.
Apply non-corrosive flux of the type recommended by filler alloy manufacturer, evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly using oxygen-acetylene torch with tip size recommended by fitting manufacturer. Wipe and brush joint clean after alloy has set.

2. Remove discs from solder end valves during brazing.

E. Mechanically Coupled Grooved Joints:

1. Mechanical coupling connections shall mechanically engage, lock and seal the grooved pipe ends in a positive couple. Each coupling shall consist of malleable iron housing clamps, steel bolts and nuts, and sealing gasket designed so internal pressure tends to increase the tightness of the seal.

2. Use grooved mechanical couplings and fasteners only in accessible locations.

3. Final tightening of bolts shall be with a torque wrench for equal tension in all bolts.

F. Mechanical Press Connection:

1. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.

2. Fully insert tubing into the fitting and mark tubing.

3. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.

4. Joint shall be pressed with a tool approved by the manufacturer.

5. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.

G. Mechanical Push-To-Connect:

1. Copper push-to-connect fittings shall be made in accordance with the manufacturer's installation instructions.

2. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.

H. Mechanical Joints:

1. Joints shall conform to ANSI A21.11 "Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings". Gasket material shall be neoprene. The standard bolts and nuts of the pipe manufacturer shall be used and shall be coated at the factory with rust preventive lubricant after threading and tapping.

2. Final tightening of bolts shall be with a torque wrench to insure equal tension in all bolts.

I. Push-On Joints - Pressure Pipe:

1. Joints shall be single gasket type conforming to ANSI A21.11 "Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings". The bell shall have cast or
machined gasket socket recesses, a tapered annular opening and flared socket design to provide deflections up to 5°. Plain spigot ends shall be suitably beveled for easy entry into bell, centering in gasket and compression of gasket.

2. The joint shall be liquid tight under all pressures from vacuum to 350 psig.

3. Furnish sufficient lubricant for a thin coat on each spigot end. Lubricant shall be non-toxic, impart no taste or odor to conveyed liquid, and have no deleterious effect on the rubber gasket. Lubricant shall be of such consistency that it can be easily applied to the pipe in hot and cold weather and shall adhere to either wet or dry pipe.

J. Compression Gasket Joints - Sanitary Pipe and Storm Pipe:

1. Joint shall be one-piece double seal compression type gasket made specifically for joining cast iron soil pipe. Gasket shall be neoprene, permitting joint to flex as much as 5 degrees without loss of seal. Gasket shall be extra heavy weight class, conforming to ASTM C-564.

K. Elastomeric Gaskets (Sanitary and Storm Pipe):

1. Hub and spigot pipe joints with elastomeric gaskets shall be made in accordance with the manufacturer’s installation instructions.

L. Sleeve Gaskets (No-Hub) (Sanitary and Storm Pipe):

1. Gasket shall be heavy weight class, conforming to ASTM C564.

2. The gasket shall have an internal center stop.

3. The gasket shall be covered by a stainless steel band secured with a minimum of four stainless steel bands per fitting/joint.

4. Sleeve gaskets shall be installed in accordance with the manufacturer’s installation instructions.

3.10 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfection of the domestic water piping shall be completed within three (3) weeks prior to building occupancy. Contractor is responsible for disinfecting water piping if used by workers during construction; disinfection during construction does not eliminate the requirement for final disinfection prior to occupancy. Flushing of piping shall be completed within two (2) weeks prior to building occupancy.

B. Provide necessary connections at the start of individual sections of mains for adding chlorine.

C. Before starting work, verify system is complete, flushed and clean.

D. Ensure pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

E. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
F. Bleed water from all outlets to ensure chlorine distribution throughout the entire domestic water system.

G. Verify initial chlorination levels by testing at minimum 15% of outlets located throughout entire building, including the last fixture connected to each main and each branch extending over 50 feet from a main.

H. Maintain disinfectant in system for 24 hours, after which test at minimum 15% of outlets located throughout entire building, including the last fixture connected to each main and each branch extending over 50 feet from a main. If final disinfectant residual tests less than 25 mg/L at any one of the tested outlets, flush the entire system and repeat disinfection and testing procedure.

I. After final disinfectant residuals test at or above 25 mg/L after a minimum 24-hour duration, flush disinfectant from system at a minimum velocity of 3.0 feet/second until residual is equal to that of incoming water or 1.0 mg/L.

J. Take water samples, no sooner than 24 hours after flushing, from 2% of outlets and from water entry. Obtain, analyze, and test samples in accordance with AWWA C651, Section 5 - Verification.

3.11 SERVICE CONNECTIONS

A. Provide new sanitary and/or storm sewer services. Before commencing work check invert elevations needed for sewer connections, confirm inverts and verify these can be properly connected with slope for drainage and cover to avoid freezing.

END OF SECTION 22 10 00
PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Pipe and Pipe Fittings.
B. Valves.
C. Natural Gas Piping System.

1.2 QUALITY ASSURANCE
A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.
B. Welding Materials, Procedures, and Operators: Conform to ASME Section 9, ANSI/AWS D1.1, and applicable state labor regulations.
C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.

1.3 REFERENCES
C. ASME - Boiler and Pressure Vessel Code - Section 9.
D. ASME B1.20.1 - Pipe Threads, General Purpose.
E. ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.
F. ASME B16.5 - Pipe Flanges and Flanged Fittings.
G. ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.
H. ASME B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.
I. ASME B16.21 - Nonmetallic Flat Gaskets for Pipes Flanges.
K. ASME B18.2.1 - Square and Hex Bolts and Screws, Inch Series.
L. ASME B18.2.2 - Square and Hex Nuts, Inch Series.
M. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
O. ASTM A181 - Forgings, Carbon Steel for General Purpose Piping.
Q. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.


1.4 DELIVERY, STORAGE, AND HANDLING

A. Store and protect piping to prevent entrance of foreign matter into pipe and to prevent exterior corrosion.

B. Deliver and store valves in shipping containers with labeling in place.

1.5 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 22 05 00 for the required natural gas piping system electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

PART 2 - PRODUCTS

2.1 NATURAL GAS (0 TO 125 PSI)

A. Design Pressure: 125 psi.

Maximum Design Temperature: 350ºF

B. Piping - 2" and Under:


2. Joints: Screwed. (NOTE: For below ground, all sizes to have welded joints.)

3. Fittings: 150# steam - 300# CWP, black malleable iron, banded, ASTM A197, ANSI B16.3.


C. Piping - 2-1/2" and Over:


2. Joints: Butt welded and flanged.


4. Flanges: 150# forged steel, weld neck or slip-on, ASTM A181, Grade I, ANSI B16.5.
D. Shutoff Valves/Throttling Valves:

1. BA-13: 2” and under, threaded 600 psi CWP; UL listed for 250# LP, flammable liquid, heating oil, natural and manufactured gases, 150 psi steam, bronze body and chrome plated brass ball, Teflon seats and packing. Apollo #80-100, Nibco #T580-70-UL or #T585-70-UL, Watts #B-6000.

2. PL-1: 2” and under, 125# steam @ 450°F, 175# CWP @ 180°F, cast iron body, screwed, full port. Walworth #1700, DeZurik #425, S-RS49.

3. PL-2: 2-1/2” thru 4”, 125# steam @ 450°F, 175# CWP @ 180°F, flanged, cast iron body, full port. Walworth #1700F, DeZurik #425, F-RS49.

E. Check Valves:

1. CK-1: 2” and under, 125# steam @ 406°F, 200# CWP @ 150°F, screwed, bronze, horizontal swing. Crane #37, Hammond #IB904, Stockham #B319-Y, Walworth #3406, Milwaukee #509, Watts #B-5000, Nibco Y-413B.

2. CK-13: 2-1/2” thru 12”, 200# CWP, double disc wafer type, iron body, bronze or aluminum-bronze discs, 316SS shaft and spring, Viton, EPDM or BUNA-N, Cv of at least 700 in 6” size. Mueller Steam Specialty Co. #71-AHB-6-H, Stockham #WG-961 EPDM or #WG970 BUNA, NIBCO W-920-W, Crane.

F. Strainers:

1. ST-2: Cast iron body, 125 lb. flanged ends, bolted cover, 125 psi S @ 350°F, 175 psi CWP @ 150°F. Armstrong #A1FL, Metraflex #TF, Mueller Steam Specialty Co.#751, Sarco #CI-125, Watts #77F-D.

2. ST-4: Cast iron body, screwed ends, screwed cover, 250# steam @ 406°F, 300# CWP @ 150°F. Armstrong #A1SC, Metraflex #SM, Mueller Steam Specialty Co. #11, Sarco #IT.

2.2 STRAINERS

A. Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>1/4” - 3”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gases</td>
<td>1/32”</td>
</tr>
</tbody>
</table>

B. Furnish pipe nipple with shutoff valve to blow down all strainer screens.

C. Use iron body strainers in ferrous piping.

2.3 DRAIN VALVES AND BLOWDOWN VALVES

A. Drain valve and blowdown valve shall mean a shutoff valve as specified for the intended service with added 3/4” male hose thread outlet, cap, and retaining chain.
PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends, remove burrs, bevel plain end ferrous pipe.
B. Remove scale and dirt on inside and outside before assembly.
C. Connect to all equipment with flanges or unions.

3.2 TESTING PIPING

A. Low Pressure - Up to 1 psi:
   1. Test piping with 20 psi air pressure. System must hold this pressure without adding air for two hours.
B. High Pressure - Above 1 psi:
   1. Test piping with compressed air at twice the operating gas pressure, but at least 20 psi. System must hold this pressure without adding air for two hours.
C. A non-combustible odorant, such as oil of wintergreen, may be added to help locate leaks.

3.3 CLEANING PIPING

A. Assembly:
   1. Prior to assembly of pipe and piping components, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer. Blow chips and burrs out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
   2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing to the degree consistent with good piping practices.
   3. Notify the Architect/Engineer prior to starting any post erection cleaning operation in time to allow witnessing the operation. Properly dispose of cleaning and flushing fluids.
   4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, control valves, and balance valves, and verify all strainer screens are in place.

3.4 INSTALLATION

A. Route piping in orderly manner, straight, plumb, with consistent pitch, parallel to building structure, with minimum use of offsets and couplings. Provide only offsets required for needed headroom or clearance and needed flexibility in pipe system.
B. Install piping to conserve building space, and not interfere with other work.
C. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Provide clearance for access to valves and fittings.

G. Provide access doors where valves are not exposed.

H. Prepare pipe, fittings, supports, and accessories for finish painting.

I. Install valves with stems upright or horizontal, not inverted.

J. Provide shutoff valves and flanges or unions at all connections to equipment, traps, and items that require servicing.

K. Provide shutoff valves to isolate part of systems and vertical risers.

L. Arrange piping and piping connections so equipment may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.

M. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it. Where pipe sizes are not shown, the larger size in either direction shall continue through the fitting nearest to the indication of a smaller pipe size.

N. Provide flanges or unions at all final connections to equipment, traps and valves.

O. Seal pipes passing through exterior walls with a wall seal per Section 23 05 29. Provide Schedule 40 galvanized sleeve at least two pipe sizes larger than the pipe.

3.5 PIPE ERECTION AND LAYING

A. Carefully inspect all pipe, fittings, valves, equipment and accessories prior to installation. Immediately reject and remove from the job any items which are unsuitable, cracked or otherwise defective.

B. All pipe, fittings, valves, equipment and accessories shall have factory-applied markings, stampings, or nameplates sufficient to determine their conformance with specified requirements.

C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any unclean item.

D. During construction, until system is fully operational, keep all openings in piping and equipment closed at all times except when actual work is being performed on that item. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.
E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be long radius type, unless otherwise shown on the drawings or specified. Construct welded elbows of angles not available as standard fittings by cutting and welding standard elbows to form smooth, long radius fittings.

F. Use full and double lengths of pipe wherever possible.

G. Cut all pipe to exact measurement and install without springing or forcing.

H. Do not create, even temporarily, undue loads, forces or strains on valves, equipment or building elements.

3.6 DRAINING AND VENTING

A. Unless otherwise indicated on the drawings, all horizontal pipes, including branches, shall pitch 1" in 40 feet to low points for complete drainage.

B. Use eccentric reducing fittings on horizontal runs when changing size for proper drainage and venting. Install gas pipes with bottom of pipe and eccentric reducers in a continuous line.

C. Provide drip legs at low points and at the base of all risers in gas pipes. Drip legs shall be full line size on pipes through 4" and at least 4", but not less than half line size over 4". Drip legs shall be 12" minimum length, capped with a reducer to a drain valve.

3.7 BRANCH CONNECTIONS

A. Make branch connections with standard tee or cross fittings of the type required for the service unless otherwise specified herein or detailed on the drawings.

B. At the option of the Contractor, branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.

C. Use of forged weld-on fittings is also limited as follows:
   1. Must have at least same pressure rating as the main.
   2. Header or main must be 2-1/2" or over.
   3. Branch line is at least two pipe sizes under header or main size.

D. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.

E. All branch piping connections for natural gas shall take off on the top or on the side of the main.
3.8 JOINING OF PIPE

A. Threaded Joints:
1. Ream pipe ends and remove all burrs and chips.
2. Protect plated pipe and valve bodies from wrench marks when making up joints.
3. Apply PTFE tape to male threads.

B. Flanged Joints:
1. Steel flanges shall be raised face.
2. Bolting for services up to 500°F shall be ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts".
3. Torque bolts in at least three passes, tightening to 1/3, 2/3, and final torque in a cross pattern with an indicating torque wrench for equal tension in all bolts.
4. Gaskets for flat face flanges shall be full face type. Gaskets for raised faced flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Unless otherwise specified gaskets shall meet the following requirements:
   a. Gasket material and thickness approved by manufacturer for intended service, chemical compatibility, pipe system test pressure, and operating temperature range.
   b. Maximum pressure rating of at least 250 psig.
   c. Minimum temperature rating: -10°F.
   d. Maximum temperature rating of at least 170°F for water systems operating 140°F and less.

C. Welded Joints:
1. Welding of all pipe joints, both as to procedures and qualification of welders, shall be in accordance with Section IX, ASME "Boiler & Pressure Vessel Code" unless local codes take precedence.
2. Furnish certificates qualifying each welder to the Owner's Representative prior to start of work.
3. The Owner's Representative reserves the right to require qualifying demonstration, at the Contractor's expense, of any welders assigned to the job.
4. Ends of pipe and fittings to be joined by butt-welding shall be beveled, cleaned to bare metal and internal diameters aligned before tack welding.
5. Backing rings shall be used for all butt weld joints 3" size and over, and for all sizes where operating pressure is over 200 psig and/or temperature is over 400°F. Backing rings shall be of the material being welded.
3.9 PAINTING EXPOSED PIPE

A. Paint all outdoor exposed natural gas piping the color selected by Owner or Architect/Engineer.

3.10 SERVICE CONNECTIONS

A. Provide new gas service complete with gas meter and regulators. Verify gas service pressure with the Utility Company.

END OF SECTION
SECTION 22 10 30  
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Roof, Floor Drains, and Floor Sinks.  
B. Cleanouts.  
C. Traps.  
D. Trap Primers.  
E. Backflow Preventers.  
F. Strainers.  
G. Unions.  
H. Balancing Valves.  
I. Water Hammer Arresters.  
J. Dielectric Fittings (Connections Between Dissimilar Metals).  
K. Air Vents.  
L. Drain Valves.  
M. Relief Valves.  
N. Compressed Air Filters.  
O. Compressed Air Condensate Traps.

1.2 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

1.3 REFERENCES

A. ANSI A112.21.1 - Floor Drains.  
B. ANSI A112.21.2 - Roof Drains.  
C. ASSE 1010 - Water Hammer Arresters.  
D. ANSI A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers.  
E. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers; American Society of Sanitary Engineering; 1.  
F. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering.  
G. PDI WH-201 - Water Hammer Arresters.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Provide cleanouts as shown and specified on the drawings as well as required by code.  
B. Coordinate floor cleanout cover with surrounding floor finish. Provide either solid, recessed for tile or terrazzo or carpet marker as applicable.
C. Cleanouts on exposed pipes shall be cast iron with heavy duty cast brass plug with raised head.

D. Cleanout shall be same size as the pipe up to 6” and 6” for larger pipes.

2.2 YARD CLEANOUTS

A. Provide yard cleanouts as shown and specified on the drawings as well as required by code.

B. Cleanout shall be same size as pipe up to 6” and 6” for larger pipes.

2.3 TRAPS

A. Provide all individual connections to the sanitary system with P-traps, except where such drains discharge directly into a properly trapped collection basin or sump. Unless otherwise specified or shown, traps shall be:

1. Chromium plated cast brass when used with plumbing fixtures or when installed exposed in finished spaces.

2. Insulated at accessible lavatories.

3. Cast iron, deep-seal pattern where concealed above ceiling, below grade or in unfinished areas.

B. All traps shall have accessible, removable cleanouts, except where installed on floor drains with removable strainers.

C. Each trap shall be completely filled with water at the end of construction but before building turnover to the Owner. All floor drains, floor sinks, trench drains, etc. shall be filled with water and a 1/2” minimum layer of mineral oil.

2.4 TRAP PRIMERS

A. Provide trap primers as shown and specified on the drawings.

2.5 FLOOR DRAINS AND SINKS

A. Provide floor drains and sinks as shown and specified on the drawings as well as required by code.

2.6 ROOF DRAINS

A. Provide roof drains as shown and specified on the drawings as well as required by code.

2.7 BACKFLOW PREVENTERS

A. Provide backflow preventers as shown and specified on the drawings as well as required by code.
2.8 STRAINERS

A. Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>1/4&quot; - 2&quot;</th>
<th>2-1/2&quot; - 10&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>air</td>
<td>1/32&quot;</td>
<td>3/64&quot;</td>
</tr>
<tr>
<td>water</td>
<td>3/64&quot;</td>
<td>1/16&quot;</td>
</tr>
</tbody>
</table>

B. Furnish pipe nipple with shutoff valve to blow down all strainer screens.

C. Use bronze body strainers in copper piping and iron body strainers in ferrous piping.

2.9 UNIONS

A. Copper pipe - wrought copper fitting - ground joint.

B. Black Steel (Schedule 40) Pipe - malleable iron, ground joint, 150 psi, bronze to bronze seat.

C. Galvanized Steel Pipe - galvanized malleable iron, ground joint, 150 psi, bronze to bronze seat.

2.10 BALANCING VALVE

A. Rated for 125 psi working pressure and 250°F operating temperature, taps for determining flow with a portable meter, positive shutoff valves for each meter connection, memory feature, tight shutoff, and a permanent pressure drop between 1’ and 2’ water column at full flow with valve 100% open. Furnish with molded, removable insulation covers.

B. Provide a nomograph to determine flow from meter reading (and valve position on units which sense pressure across a valve). Graph shall extend below the specified minimum flow.


D. Flow rate less than 0.5 GPM: Valves in copper piping shall be brass or bronze. Cv value shall be less than 1.0 when valve is completely open, and minimum balanceable flow rate shall not exceed 0.1 GPM with a meter reading of at least 2.5 feet. Acceptable manufacturers: Bell & Gossett "Circuit Setter RF", Flow Design, Preso, Armstrong, Griswold, Gerard, or Nibco balancing valve.

E. Manufacturer shall size balancing valves for the scheduled flow rate. Flow rate shall be measurable on manufacturer's standard meters.

2.11 WATER HAMMER ARRESTERS

A. Provide water hammer arresters as shown and specified on the drawings as well as required by code.

B. ANSI A112.26.1; sized and located in accordance with PDI WH-201, precharged for operation between -100°F and 300°F and maximum 250 psig working pressure.
2.12 DIELECTRIC FITTINGS (CONNECTIONS BETWEEN DISSIMILAR METALS)

A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.

B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.

C. Aluminum, iron, steel, brass, copper, bronze, and stainless steel are commonly used and require isolation from each other with the following exceptions:
   1. Iron, steel, and stainless steel connected to each other.
   2. Brass, copper, and bronze connected to each other.
   3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.

D. Dielectric protection is required at connections to equipment of a material different than the piping.

E. Screwed Joints (acceptable up to 2" size):
   1. Dielectric waterway rated for 300 psi CWP and 225°F.

F. Flanged Joints (any size):
   1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.
   2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
   3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.
   4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
   5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
2.13 **AIR VENTS**

A. Provide means for venting air at all high points in the piping system and at all other points where air may be trapped.

B. At end of main and other points where large volume of air may be trapped - Use 1/4” globe valve, angle type, 125 psi, Crane #89, attached to coupling in top of main, 1/4” discharge pipe turned down with cap.

2.14 **DRAIN VALVES**

A. Drain valves shall be shutoff valves as specified for the intended service with added 3/4” male hose thread outlet and cap.

2.15 **RELIEF VALVES**

A. RV-3: (Compressed Air) Spring loaded disc type, cast iron or steel body, stainless steel disc, side outlet and lifting lever, 250# CWP. Acceptable Manufacturers: Consolidated Div. of Dresser Ind. Series 1900, Kunkle #463, Keckley Type 41.


2.16 **COMPRESSED AIR FILTERS**

A. Filters shall have a stainless steel sleeve, micro-glass media with epoxy coating, elastomeric filter to housing seal and sealed end caps.

B. Filters shall be capable of removing the following:

1. All solids 3 microns and larger.
2. Liquids up to 25,000 ppm by weight.
3. 99% of water droplets.
4. 40% of oil aerosols.

C. Provide a differential pressure alarm for each filter. Range shall be adjustable from 10 to 35 psi differential at 100 psig.

D. Acceptable Manufacturer: Hankison.

**PART 3 - EXECUTION**

3.1 **INSTALLATION AND APPLICATION**

A. Coordinate construction to receive drains at required invert elevations.

B. Install all items per manufacturer's instructions.

C. Water Hammer Arresters:

1. Install water hammer arresters in accessible locations. Provide access doors as required. Coordinate type with Architect/Engineer/Owner.
2. Water hammer arrestors shall be installed in cold and hot water lines upstream of all plumbing fixtures or equipment, with a quick acting valve or multiple quick acting valves. Quick acting valves shall be defined as solenoid actuated valves, manual flush valves, sensor activated faucets and flush valves, squeeze handle spray faucets, and other similar type valves.

3. Install multiple water hammer arrestors in toilet group branch piping greater than 20 feet in developed length from the cold and hot water mains.

D. Cleanouts:

1. Provide cleanouts where shown on the drawings and as required by code, but in no case farther apart than 50 feet in pipe less than 6" size and 100 feet apart in 6" and larger pipes inside the building.

2. Provide cleanouts at bases of all sanitary and storm risers as shown on the drawings and as required by code.

3. Extend cleanouts to the floor with long sweep elbows.

4. Install a full size, two-way cleanout within 5 feet of the foundation inside or outside of building.

5. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with graphite and linseed oil. Ensure clearance at cleanouts for rodding of drainage system.

6. Wall cleanouts shall be installed above the flow line of the pipe they serve, but no less than 12" above the finished floor.

E. Yard Cleanouts:

1. Extend cleanout to grade. Encase cleanout in 5" thick concrete pad extending 6" beyond cleanout, set low enough not to interfere with lawn mowers.

F. Floor Drains:

1. Drains in upper floors shall have a flashing of EPDM or similar membrane sheet. The sheet shall be at least 36" X 36" square with the drain in the center. Clamp membrane in auxiliary clamping ring of floor drain. Membrane is not required if upper floor construction is single pour, cast-in-place concrete.

2. Use alternate sealing method when installing drains in existing floor slabs.

3. Coordinate sloping requirements with the architectural plans and specifications.

G. Roof Drains:

1. Roof drains shall have bearing pans.

2. Provide auxiliary support steel under drains as required to prevent movement of the drain.

3. All roof drains shall have underdeck clamps.
4. Drains in built-up roofing systems shall have a 36” x 36”, 3 lb density lead sheet flashing.

H. Backflow Preventer:

1. Provide an air gap fitting and piping to drain. On 2-1/2” and larger units, install a tail piece from air gap fitting to drain to prevent water from spraying out of drain air gap receptor. Maintain air gap distance required by Code.

2. Units shall be field tested and tagged in accordance with manufacturer’s instructions and applicable codes by a certified tester before initial operation.

3. Install unit between 12” and 60” above finish floor.

I. Balancing Valves:

1. Install balancing valves with straight, unobstructed pipe section both upstream and downstream as required, per manufacturer’s installation instructions.

END OF SECTION 22 10 30
SECTION 22 11 23
DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Domestic Water In-Line Circulators.

1.2 SUBMITTALS
   A. Submit shop drawings under provisions of Section 22 05 00.
   B. Submit certified pump performance curves with pump and system operating point plotted. Include NPSH curve when applicable.
   C. Pumps with motors operating above the RPM the pump curves are based on shall have impellers trimmed to deliver GPM and head scheduled.

PART 2 - PRODUCTS

2.1 GENERAL
   A. Statically and dynamically balance rotating parts.
   B. Construction shall permit complete servicing without breaking piping or motor connections.
   C. Pumps shall operate at 1750 rpm unless specified otherwise.
   D. Pump connections shall be flanged, whenever available.
   E. Domestic hot water pumps shall be suitable for 225°F water.
   F. Motors shall comply with Section 22 05 13.
   G. Submitted pump selections must have a diameter impeller that meets or exceeds the scheduled pump. The inlet and discharge pipe sizes shall also meet or exceed the scheduled pump.

2.2 DOMESTIC WATER IN-LINE CIRCULATORS
   A. Provide pumps as specified on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. General Installation Requirements:
      1. Install all products per manufacturer's recommendations.
      2. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
B. In-Line Pump:

1. Support in-line pumps individually so there is no strain on the piping. Support pump so no weight is carried on pump casings. Install with a minimum of five diameters of straight pipe on pump suction and discharge.

2. Ensure pumps operate at specified fluid temperatures without vapor binding or cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.

3. Pumps shall be factory aligned. If alignment is not satisfactory, as determined by the Architect/Engineer, manufacturer shall provide a factory trained representative to field align the shafts.

C. Pump without VFD:

1. For pumps not powered by a VFD, trim impeller to meet maximum operating conditions. Coordinate final trimmed diameter with Testing, Adjusting, and Balancing Contractor.

END OF SECTION 22 11 23
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Water Heaters.

1.2 QUALITY ASSURANCE

A. Products and installation of specified products shall conform to recommendations and requirements of the following organizations:

1. American Gas Association (AGA).
2. National Sanitation Foundation (NSF).
3. American Society of Mechanical Engineers (ASME).
4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
6. Underwriters' Laboratories (UL).

B. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR, ANSI Z21.10.1 and ANSI Z21.10.3.

C. Conform to ASME Section VIII for construction of water heaters and heat exchangers. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

1.3 REFERENCES


B. ANSI/ASME Section 8D - Pressure Vessels.

C. ANSI Section 21.10.1 or Section ANSI 21.10.3 - Gas Water Heaters Ratings 75,000 BTU per Hour and Less.


1.4 SUBMITTALS

A. Submit shop drawings under provisions of Section 22 05 00.

B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.

C. Include heat exchanger dimensions, size of tappings, and performance data.
D. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

E. For equipment connected to an electric power source, submit short circuit rating (SCCR) of integrated unit.

F. Submit manufacturer's installation instructions including control and wiring diagrams.

G. Submit manufacturer's certificate that pressure vessels meet or exceed specified requirements.

H. Submit operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.6 REGULATORY REQUIREMENTS

A. Water heaters shall conform to AGA, ANSI/NFPA 54, ANSI/NFPA 70, ANSI/UL 1453 as applicable.

B. Conform to ANSI/ASME Section 8 Division 1 for fabrication of steel pressure vessels.

PART 2 - PRODUCTS

2.1 WATER HEATERS

A. All water heaters shall be as scheduled on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all items in accordance with manufacturer's instructions.

3.2 WATER HEATER INSTALLATION

A. Install water heaters on concrete bases. Coordinate sizes and locations of concrete bases. Refer to Section 22 05 29.

B. Install water heaters level and plumb, according to drawings, manufacturer's instructions, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend drain piping full size from relief valve and discharge by positive air gap onto closest floor drain. Discharge pipe material shall be same as domestic water piping.

D. Install gas water heaters according to NFPA 54.

END OF SECTION 22 30 00
SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. All plumbing fixtures.

1.2 REFERENCES
A. ANSI A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
B. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
C. ANSI A112.19.2M - Vitreous China Plumbing Fixtures.
D. AHRI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
E. Americans with Disabilities Act (ADA), Title III.

1.3 SUBMITTALS
A. Submit product data under provisions of Section 22 05 00. Submittals shall include fixture carriers for record purposes only. Architect/Engineer does not review or approve carriers except for manufacturer.
B. Include fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Wall Hung Fixture Carriers:
   1. Material: All Metal, ASME/ANSI A112.6.1M.
   3. Water closet carrier shall be rated to support 500 lbs. unless noted otherwise on the drawings.
B. All fixtures shall be as scheduled on the drawings.
C. All china shall be from the same manufacturer where possible.
D. All lavatory and sink trim shall be from the same manufacturer where possible.
E. All fixtures shall be lead free. Faucets, traps, stops, and other fixture accessories shall not contain more lead than allowed per the latest State or Federal Act.
PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2. Install each fixture with trap easily removable for servicing and cleaning. Use screwed tailpiece couplings. Connect fixture waste to stack with slip fitting.

3. Provide fixtures with chrome plated rigid or flexible supplies, loose key stops, reducers, and escutcheons.

4. Install components level and plumb.

5. Caulk joint between finish floor and floor mounted fixtures and between finish walls and wall mounted fixtures with silicon caulk. Caulk the joint, between rim and fixture where a fixture builds into a counter top, with caulking compound. Refer to DIVISION 7 for "Caulking" requirements. Color to match fixture.

6. Where there is a possibility of water following pipe brackets, etc., into a wall; caulk escutcheons, space around brackets, etc., to exclude water. Refer to DIVISION 7 for "Caulking" requirements.

7. Refer to Plumbing Material List for fixture mounting heights.

8. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.

B. Wall-Mounted Fixture Requirements:

1. All wall-mounted fixtures shall have compatible carriers designed for their intended service and suitable for the space available and configuration of fixtures. All carriers shall extend to the floor and be anchored to the slab.

C. Floor-Mounted Fixture Requirements:

1. Where floor mounted fixtures are installed on a sloped floor, the open void below the fixture shall be grouted, leveled, and caulked to eliminate stress on the fixture and to prevent water migration to the floor below.

D. Exposed or Inside Accessible Cabinets Traps, Valve and Pipe Requirements:

1. All traps exposed under fixtures or inside accessible cabinets shall be chrome plated brass.

2. All water or waste piping for plumbing fixtures that is exposed or inside cabinets shall be chrome plated.

3. All exposed flush valves for water closets and urinals shall have a chrome plated hanger to anchor the piping to the wall.
4. All exposed water supply piping and fittings in a finished space to a shower valve, hose bibb, or other water outlet shall be chrome plated.

E. Exposed Sink and Lavatory Trim:
   1. All exposed sink and lavatory traps, piping and angle stops shall be installed with an insulating kit specially manufactured for this installation. Armaflex with duct tape is not acceptable.

F. ADA Water Closet Requirements:
   1. Handicapped accessible water closet flush valve handles shall face the center of the stall.
   2. Coordinate flush valves in handicap accessible locations with grab bars installed by the General Contractor. Make modifications required to flush valve after review by Architect/Engineer.

3.2 ADJUSTING AND CLEANING
   A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
   B. At completion, clean plumbing fixtures, equipment, and faucet aerator screens.

3.3 FIXTURE ROUGH-IN SCHEDULE
   A. Rough-in fixture piping connections in accordance with table on plumbing drawings of minimum sizes for particular fixtures.

END OF SECTION 22 40 00