PROJECT MANUAL
CONSTRUCTION DOCUMENTS

HIDALGO COUNTY PCT. 2
COUNTY WIDE SERVICE SHOP
4011 S. VETERANS BLVD.
SAN JUAN, TEXAS 78589

Volume I

Set Number_____

JULY 01, 2016

DOCUMENT 00 01 01
PROJECT TITLE PAGE

PROJECT MANUAL – 100% CONSTRUCTION DOCUMENTS

PROJECT DETAILS

Project consists of a new Building Facility as follows:
Approximate Building Gross Area 16,504 S.F.
Hidalgo County Pct. 2 County Wide Service Shop
Located at 4011 S. Veterans Blvd., San Juan, Texas 78589

OWNER

County of Hidalgo
3100 South Business Highway 281, Suite D
Edinburg, Texas 78539

OWNER REPRESENTATIVE

Hidalgo County Precinct 2
Mr. Armando Pompa
Director of Field Operations

ARCHITECT

Laura N. Warren Ogletree, AIA/President
The Warren Group Architects, Inc.
1801 S. 2nd Street, Suite 330
McAllen, Texas 78503
Office_956.994.1900
lwarren@twgarch.com

END OF DOCUMENT

DOCUMENT 00 01 07
SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

ARCHITECT	The Warren Group Architects Inc. Texas Registration No. 30112289 Sections except where indicated as prepared by other design professionals of record.

SEAL

EXP 10-31-2016

END OF DOCUMENT

DOCUMENT 00 01 07
SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

McHALE ENGINEERING INC.
FIRM NUMBER F-2854

STRUCTURAL ENGINEER McHale Engineering Inc.

Gary B. McHale

TEXAS REGISTRATION NUMBER 45753

8-26-2016

Sections except where indicated as prepared
by other design Professionals of Record

The following sections:

31 63 30 - CONTINUOUS AND INDIVIDUAL SPREAD FOOTINGS
03 11 13 - CONCRETE FORMWORK
03 21 00 - REINFORCING STEEL
03 30 00 - CAST-IN-PLACE CONCRETE
03 35 00 - CONCRETE FINISHING

END OF DOCUMENT

DOCUMENT 00 01 10
TABLE OF CONTENTS

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

Cover Sheet
Section 00 01 01 - Project Title Page
Section 00 01 07 - Seals Page- Architect
Seals Page- Structural
Seals Page- MEP
Section 00 01 10 - Table of Contents
Section 00 01 15 - List of Drawing Sheets
Section 00 11 16 - Invitation to Bid
Section 00 21 13 - Instructions to Bidders
Section 00 22 13 - Supplementary Instructions to Bidders
Section 00 25 13 - PreBid Meeting
Section 00 26 00 - Procurement Substitution Procedures
CSI Request Form 1.5C
Section 00 41 13 - Bid Form- Stipulated Sum (Single Prime Contract)
Section 00 43 73 - Proposed Schedule of Values Form
Section 00 60 00 - Forms
Section 00 72 00 - General Conditions Notice
Section 00 73 00 - Supplementary Conditions

DIVISION 01 - GENERAL REQUIREMENTS

Section 01 01 00 - General Scope of Work
Section 01 15 00 - Contract Standards and Procedures
Section 01 25 00 - Substitution Procedures
Section 01 29 00 - Payment Procedures
Section 01 31 00 - Project Management and Coordination
Section 01 32 33 - Photographic Documentation
Section 01 33 00 - Submittal Procedures
Section 01 33 23 - Shop Drawings and Samples
Section 01 45 23 - Testing and Inspecting Services
Section 01 50 00 - Temporary Facilities and Controls
Section 01 70 00 - Project Closeout
Section 01 73 00 - Execution
Section 01 81 19 - Indoor Air Quality Requirements

DIVISION 02 - EXISTING CONDITIONS

Section 02 28 20 - Termite Control
Section 02 41 19 - Selective Demolition

DIVISION 03 - CONCRETE

Section 03 11 13 - Concrete FormWork
Section 03 21 00 - Reinforcing Steel
Section 03 30 00 - Cast-In-Place Concrete
Section 03 35 00 - Concrete Finishing

DIVISION 05 - METALS

Section 05 40 00 - Cold-Formed Metal Framing
Section 05 50 00 - Miscellaneous Metal Work

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

Section 06 10 00 - Rough Carpentry
Section 06 16 43 - Gypsum Sheathing
Section 06 20 00 - Finish Carpentry

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

Section 07 21 00 - Thermal Insulation
Section 07 21 20 - Board Insulation
Section 07 60 00 - Sheet Metal Work
Section 07 70 00 - Roof and Wall Specialties and Accessories
Section 07 90 00 - Joint Protection

DIVISION 08 - OPENINGS

Section 08 11 13 - Hollow Metal Doors and Frames
Section 08 33 23 - Overhead Coiling Doors
Section 08 71 00 - Door Hardware

DIVISION 09 - FINISHES

Section 09 24 00 - Cement Plastering
Section 09 28 13 - Cementitious Backing Boards
Section 09 29 00 - Gypsum Wallboard
Section 09 31 00 - Thin-Set Tile Work
Section 09 51 13 - Acoustical Panel Ceilings
Section 09 65 13 - Resilient Bases and Accessories
Section 09 81 00 - Acoustic Insulation
Section 09 90 00 - Paints and Coatings

DIVISION 10 - SPECIALTIES

Section 10 14 00 - Signage
Section 10 28 13 - Toilet Accessories
Section 10 44 00 - Fire Protection Specialties

DIVISION 31 - EARTHWORK

Section 31 63 30 - Continuous and Individual Spread Footings

DOCUMENT 00 01 15
LIST OF DRAWING SHEETS

LIST OF DRAWINGS

A. Drawings: Consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Charles Clark Chevrolet Dealership Renovations, McAllen, Texas 78501 dated October 17, 2014, as modified by subsequent Contract modifications.

B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

ARCHITECTURAL:

G0.00	COVER SHEET
G0.01	GENERAL NOTES
G0.02	ABBREVIATIONS & SYMBOLS
A1.01	SITE PLAN
A1.11	FLOOR PLANS
A1.21	REFLECTED CEILING PLANS
A1.31	ROOF PLAN
A2.11	EXTERIOR ELEVATIONS
A3.01	BUILDING SECTIONS
A3.11	WALL SECTIONS
A4.11	ENLARGED FLOOR PLAN
A6.01	WALL SCHEDULES
A6.11	FINISH SCHEDULE DOOR & WINDOW SCHEDULES

STRUCTURAL

S-1	FOUNDATION PLAN
S-2	FOUNDATION DETAILS

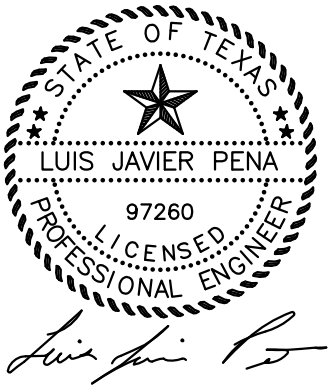
MECHANICAL - ELECTRICAL - PLIMBING

MEP1.00 SITE PLAN
M1.1 MECHANICAL PLAN – 1ST LEVEL
M2.1 MECHANICAL SCHEDULES
E1.1 ELECTRICAL LIGHTING- 1ST FLOOR
E2.00 ELECTRICAL POWER- 1ST FLOOR
P1.1 SEWER PLAN- 1ST LEVEL

END OF DOCUMENT

MEP ENGINEERS MEP Solutions Engineering
Texas Registration No. F-9748
Luis Javier Peña, P.E.
Texas Registration No. 97260
The following sections:

15010 - MECHANICAL GENERAL REQUIREMENTS
15050 - MECHANICAL MATERIALS AND METHODS
15067 - HANGERS AND SUPPORTS
15077 - MECHANICAL IDENTIFICATION
15080 - MECHANICAL INSULATION
15110 - VALVES
15140 - DOMESTIC WATER PIPING
15150 - SANITARY WASTE AND VENT PIPING
15410 - PLUMBING FIXTURES
15430 - PLUMBING SPECIALTIES
15738 - SPLIT SYSTEM AIR CONDITIONING UNITS
15815 - METAL DUCTS
15820 - DUCT ACCESSORIES
15838 - POWER VENTILATORS
15855 - DIFFUSERS, REGISTERS, AND GRILLES
15950 - TESTING ADJUSTING AND BALANCING



8.12.16

MEP SOLUTIONS ENGINEERING
MECHANICAL, ELECTRICAL, PLUMBING ENGINEERS
600 E. BEAUMONT AVE. SUITE 2 McALLEN, TX 78501 (956) 664-2727
TEXAS BOARD OF PROFESSIONAL ENGINEERS REGISTRATION # F-9748

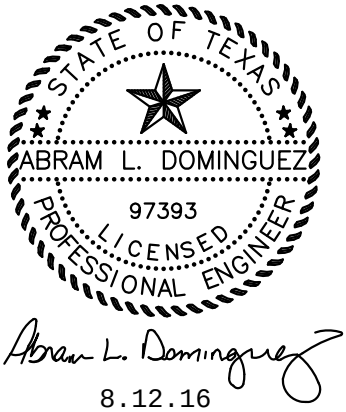
END OF DOCUMENT

DOCUMENT 00 01 07
SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

MEP ENGINEERS MEP Solutions Engineering
Texas Registration No. F-9748
Abram L. Dominguez, P.E.
Texas Registration No. 97393
The following sections:

16051 - COMMON WORK RESULTS FOR ELECTRICAL
16060 - GROUNDING AND BONDING
16075 - ELECTRICAL IDENTIFICATION
16120 - CONDUCTORS AND CABLES
16130 - RACEWAYS AND BOXES
16140 - WIRING DEVICES
16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS
16442 - PANELBOARDS
16511 - INTERIOR LIGHTING



MEP SOLUTIONS ENGINEERING
MECHANICAL, ELECTRICAL, PLUMBING ENGINEERS
600 E. BEAUMONT AVE. SUITE 2 McALLEN, TX 78501 (956) 664-2727
TEXAS BOARD OF PROFESSIONAL ENGINEERS REGISTRATION # F-9748

DOCUMENT 00 11 16
INVITATION TO BID

1.1 PROJECT INFORMATION

A. Notice to Bidders: Bidders invited to submit bids for Project as described in this Document according to the Instructions to Bidders. General Contractor to submit a Contractors Qualifications Statement to include company project history comparable in project size, similar projects, financial capability, litigation status, and bonding capabilities.

B. Project Identification: Project Number 1341501.
Hidalgo County Pct. 2 County Wide Service Shop
Located at 4011 S. Veterans Blvd., San Juan, Texas 78589

C. Owner: County of Hidalgo
3100 South Business Highway 281, Suite D
Edinburg, Texas 78539

D. Architect: Laura Nassri Warren, AIA/Principal
The Warren Group Architects, Inc.
1801 S. 2nd Street, Suite 330
McAllen, Texas 78503.

E. Project Description: Project consists of a new Building Facility as follows:
Approximate Building Gross Area 16,504 S.F.

a. The project is for General Construction of a new building renovation.

F. Construction Contract: Bids will be received for the following Work:

a. General Contract (all trades) - General Building Construction Renovation.

1.2 BID SUBMITTAL AND OPENING

A. Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:

1. Bid Date: To be determined.

2. Bid Time: To be determined
Owner shall have the right to reject any or all Bids.
Bids turned in after Bid Time will not be accepted.

3. Delivery Location: Hidalgo County Purchasing Department
Attention: Martha Salazar, CPPB
2812 S. Business Highway 281
Edinburg, Texas 78539

B. Bids will be opened and public read by Owner.

C. Bids shall be received from General Contractors only.

1.3 BID SECURITY

A. A Bid Bond is required by Owner.

1.4 PREBID CONFERENCE

A. A Pre-Bid Conference for all bidders will be held at the office of Hidalgo County Purchasing Department, 2812 S. Business Highway 281, Edinburg, Texas 78539.
B. Date and Time: To be determined.
C. Prime Bidders Attendance at Prebid meeting is recommended.

1. Bidders' Questions: Architect will provide responses at Prebid conference to bidders' questions received up to three business days prior to conference.

2. Bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least three days prior to the date for receipt of Bids.

1.5 DOCUMENTS

A. Online Procurement and Contracting Documents: Contact Natanael Perez at nperez@twgarch.com for a download link. Files are available for download after 4:30 pm. Date to be determined. Any other questions to be in written/e-mailed format to the attention of Laura Nassri Warren at nperez@twgarch.com and a copy to Natanael Perez. Online access will be provided to prime bidders only.

1.6 TIME OF COMPLETION AND LIQUIDATED DAMAGES

A. Successful Bidder shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time. For each day after Substantial Completion that the work remains incomplete, a penalty of $1,000.00 per day will be charged to the Contractor.

1.7 BIDDER'S QUALIFICATIONS

A. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.

1.8 NOTIFICATION

A. This Advertisement for Bids document is issued by Hidalgo County Purchasing Department, Martha Salazar, CPPB, 2812 S. Business Highway 281, Edinburg, Texas 78539.

END OF DOCUMENT

DOCUMENT 00 21 13
INSTRUCTIONS TO BIDDERS

1.1 INSTRUCTIONS TO BIDDERS

A. AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting Requirements by reference.

1. A copy of AIA Document A701, "Instructions to Bidders," is bound in this Project Manual.

END OF DOCUMENT

DOCUMENT 00 22 13
SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

1.1 INSTRUCTIONS TO BIDDERS

A. Instructions to Bidders for Project consist of the following:

1. AIA Document A701, "Instructions to Bidders", a copy of which is bound in this Project Manual.
2. The following Supplementary Instructions to Bidders that modify and add to the requirements of the Instructions to Bidders.

1.2 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS, GENERAL

A. The following supplements modify AIA Document A701, "Instructions to Bidders." Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions to Bidders, unaltered portions of the Instructions to Bidders shall remain in effect.

1.3 ARTICLE 2 - BIDDER'S REPRESENTATIONS

A. Section 2.1.3.1:

1. 2.1.3.1 - The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.

B. Section 2.1.5:

1. 2.1.5 - The Bidder is a properly licensed Contractor according to the laws and regulations of State of Texas and meets qualifications indicated in the Procurement and Contracting Documents.

C. Section 2.1.6:

1. 2.1.6 - The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

1.4 ARTICLE 3 - BIDDING DOCUMENTS

A. 3.4 - Addenda:

3.4.3 - Addenda may be issued at any time prior to the receipt of bids.

1. Section 3.4.4.1:

    a. 3.4.4.1 - Owner may elect to waive the requirement for acknowledging receipt of 3.4.4 Addenda as follows:

        1) 3.4.4.1.1 - Information received as part of the Bid indicates that the Bid, as submitted, reflects modifications to the Procurement and Contracting Documents included in an unacknowledged Addendum.

        2) 3.4.4.1.2 - Modifications to the Procurement and Contracting Documents in an unacknowledged Addendum do not, in the opinion of Owner, affect the Contract Sum or Contract Time.

1.5 ARTICLE 4 - BIDDING PROCEDURES

A. 4.1 - Preparation of Bids:

1. Section 4.1.1.1:

    a. 4.1.1.1 - Printable electronic Bid Forms and related documents are available from a downloadable link.

2. Section 4.1.9:

    a. 4.1.9 - Owner may elect to disqualify a bid due to failure to submit a bid in the form requested, failure to bid requested alternates or unit prices, failure to complete entries in all blanks in the Bid Form, or inclusion by the Bidder of any alternates, conditions, limitations or provisions not called for.

3. Section 4.1.10:

    b. 4.1.10 **-** Bids shall include sales and use taxes.

B. 4.3 - Submission of Bids:

1. Section 4.3.1.2:

    a. 4.3.1.2 - Include Bidder's Contractor License Number applicable in Project jurisdiction on the face of the sealed bid envelope.

C. 4.4 - Modification or Withdrawal of Bids:

1. Section 4.4.2:

    a. 4.4.2.1 - Such modifications to or withdrawal of a bid may only be made by persons authorized to act on behalf of the Bidder. Authorized persons are those so identified in the Bidder's corporate bylaws, specifically empowered by the Bidder's charter or similar legally binding document

acceptable to Owner, or by a power of attorney, signed and dated, describing the scope and limitations of the power of attorney. Make such documentation available to Owner at the time of seeking modifications or withdrawal of the Bid.

b. 4.4.2.2 - Owner will consider modifications to a bid written on the sealed bid envelope by authorized persons when such modifications comply with the following: the modification is indicated by a percent or stated amount to be added to or deducted from the Bid; the amount of the Bid itself is not made known by the modification; a signature of the authorized person, along with the time and date of the modification, accompanies the modification. Completion of an unsealed bid form, awaiting final figures from the Bidder, does not require power of attorney due to the evidenced authorization of the Bidder implied by the circumstance of the completion and delivery of the Bid.

D. 4.5 - Break-Out Pricing Bid Supplement:

1. Section 4.5:

a. 4.5 - Provide detailed cost breakdowns on forms provided no later than two business days following Architect's request.

E. 4.6 - Subcontractors, Suppliers, and Manufacturers List Bid Supplement:

1. Section 4.6:

a. 4.6 - Provide list of major subcontractors, suppliers, and manufacturers furnishing or installing products on forms provided no later than two business days following Architect's request. Include those subcontractors, suppliers, and manufacturers providing work totaling three percent or more of the Bid amount. Do not change subcontractors, suppliers, and manufacturers from those submitted without approval of Architect.

1.6 ARTICLE 5 - CONSIDERATION OF BIDS

A. 5.2 - Rejection of Bids:

1. Section 5.2.1:

A. 5.2.1 - Owner reserves the right to reject a bid based on Owner's and Architect's evaluation submitted following opening of bids. Owner's evaluation of the Bidder's qualifications will include: Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.

1.7 ARTICLE 6 - POSTBID INFORMATION

A. 6.1 - Contractor's Qualification Statement:

1. Section 6.1.1:

a. 6.1.1 - Submit Contractor's Qualification Statement no later than two business days following Architect's request.

B. 6.3 - Submittals:

1. Add Section 6.3.1.4:

a. 6.3.1.4 - Submit information requested in Sections 6.3.1.1, 6.3.1.2, and 6.3.1.3 no later than two business days following Architect's request.

1.8 ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

A. 7.1 - Bond Requirements:

1. Add Section 7.1.1.1:

a. 7.1.1.1 - Both a Performance Bond and a Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum.

B. 7.2 - Time of Delivery and Form of Bonds:

1. Section 7.2.1:

a. The Bidder shall deliver the required bonds to Owner no later than (10) Ten days after the date of Notice of Intent to Award and no later than the date of execution of the Contract, whichever occurs first. Owner may deem the failure of the Bidder to deliver required bonds within the period of time allowed a default.

2. Section 7.2.3:

a. Bonds shall be executed and be in force on the date of the execution of the Contract.

1.9 ARTICLE 8 - FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

A. AIA 101 Forms, Owner/Contractor Agreement-Stipulated Sum.

1.10 ARTICLE 9 - EXECUTION OF THE CONTRACT

A. Add Article 9:

1. 9.1.1 - Subsequent to the Notice of Intent to Award, and within 10 days after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to Owner through The Warren

Group Architects, Inc, Laura Nassri Warren, AIA/Principal, in such number of counterparts as Owner may require.

2. 9.1.2 - Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds when the Agreement is presented for signature within the period of time allowed.

3. 9.1.3 - Unless otherwise indicated in the Procurement and Contracting Documents or the executed Agreement, the date of commencement of the Work shall be the date of the executed Agreement or the date that the Bidder is obligated to deliver the executed Agreement.

4. 9.1.4 - In the event of a default, Owner may declare and elect to either award the Contract to the next responsible bidder or re-advertise for bids.

END OF DOCUMENT

DOCUMENT 00 25 13
PREBID MEETING

1.1 PREBID MEETING

A. Owner and Architect, will conduct a Prebid meeting as indicated below:

1. Meeting Date: To be determined.

2. Meeting Time: To be determined

3. Location: Hidalgo County Purchasing Department, 2812 S. Business Highway 281, Edinburg, Texas 78539 or Hidalgo County Precinct #2, 300 West Hall Acres, Suite G, Pharr, Texas 78577.

B. Attendance:

1. Prime Bidders: Attendance at Prebid meeting is recommended.

2. Subcontractors: Attendance at Prebid meeting is recommended.

C. Bidder Questions: Submit written questions to be addressed at Prebid meeting minimum of three business days prior to meeting.

D. Agenda: Prebid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:

1. Procurement and Contracting Requirements:

a. Advertisement for Bids.

b. Instructions to Bidders.

c. Insurance.

d. Bid Security.

e. Bid Form and Attachments.

f. Bid Submittal Requirements.

g. Bid Submittal Checklist.

h. Notice of Award.

2. Communication during Bidding Period:
    a. Obtaining documents.
    b. Access to Project Web site.
    c. Bidder's Requests for Information.
    d. Bidder's Substitution Request/Prior Approval Request.
    e. Addenda.
3. Contracting Requirements:
    a. Agreement.
    b. The General Conditions.
    c. The Supplementary Conditions.
    d. Other Owner requirements.
4. Construction Documents:
    a. Scopes of Work.
    b. Temporary Facilities.
    c. Use of Site.
    d. Work Restrictions.
    e. Alternates and Allowances.
    f. Substitutions following award.
5. Separate Contracts:
    a. Work by Owner.
    b. Work of Other Contracts.
6. Schedule:
    a. Project Schedule.
    b. Contract Time.
    c. Liquidated Damages.

d. Other Bidder Questions.

7. Site visit.

8. Post-Meeting Addendum.

E. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes to attendees and others known by the issuing office to have received a complete set of Procurement and Contracting Documents. Minutes of meeting are issued as Available Information and do not constitute a modification to the Procurement and Contracting Documents. Modifications to the Procurement and Contracting Documents are issued by written Addendum only.

1. Sign-in Sheet: Minutes will include list of meeting attendees.

END OF DOCUMENT

DOCUMENT 00 26 00
PROCUREMENT SUBSTITUTION PROCEDURES

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. See Section 012500 "Substitution Procedures" for conditions under which Substitution requests will be considered 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 The Warren Group Architects, Inc. Procurement Substitution Request must be made in writing by prime contract Bidder only in compliance with the following requirements:

1. Requests for substitution of materials and equipment will be considered if received no later than 3 days prior to date of bid opening.

2. Submittal Format: Submit three copies of each written Procurement Substitution Request CSI Substitution Request Form 1.5C.

3. Submittal Format: Submit Procurement Substitution Request, using format provided on Project Web site.

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 City of McAllen Ordinances.

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.

B. Architect's Action:

1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect 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

SUBSTITUTION REQUEST

(During the Bidding/Negotiating Stage)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ _____ Article/Paragraph: _____

Proposed Substitution: _____

_____ Manufacturer:

_____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

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.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

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 2013, CSI,
110 South Union St., Suite 100, Alexandria, VA 22314

Form Version: January 2013
CSI Form 1.5C

1.4 SUBCONTRACTORS AND SUPPLIERS

A. The following companies shall execute subcontracts for the portions of the Work indicated:

1. General Conditions:

_____.

2. Site Work:

_____.

3. Masonry Work:

_____.

4. Structural Steel Work:

_____.

5. Masonry Work:

_____.

6. Roofing Work:

_____.

7. Plumbing Work:

_____.

8. HVAC Work:

_____.

9. Electrical Work:

_____.

1.5 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work within _____ calendar days.

1.6 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.
3. Addendum No. 3, dated _____.
4. Addendum No. 4, dated _____.
5. Addendum No. 5, dated _____.

1.7 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and are attached hereto.
1. Bid Form Supplement - Instructions to Bidders (AIA Document A701).
2. Bid Form Supplement - CSI Form 1.5C Substitution Request

1.8 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the State of Texas and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.9 DOCUMENT CONTINUES

1.10 SUBMISSION OF BID

Respectfully submitted this ____ day of _____, 2017.

Submitted By: _____
(Name of bidding firm or corporation)

Authorized Signature: _____
(Handwritten signature)

Signed By: _____
(Type or print name)

Title: _____
(Owner/Partner/President/Vice President)

Witness By: _____
(Handwritten signature)

Attest: _____
(Handwritten signature)

By: _____
(Type or print name)

Title: _____
(Corporate Secretary or Assistant Secretary)

Street Address: _____

City, State, Zip _____

Phone: _____

License No.: _____

Federal ID No.: _____

(Affix Corporate Seal Here)

END OF DOCUMENT

DOCUMENT 00 43 73
PROPOSED SCHEDULE OF VALUES FORM

1.1 BID FORM SUPPLEMENT

A. A completed Proposed Schedule of Values form is required to be attached to the Bid Form.

1.2 PROPOSED SCHEDULE OF VALUES FORM

A. Proposed Schedule of Values Form: Provide a breakdown of the bid amount, including alternates, in enough detail to facilitate continued evaluation of bid. Coordinate with the Project Manual table of contents. Provide multiple line items for principal material and subcontract amounts in excess of five percent of the Contract Sum.

B. Arrange schedule of values consistent with format of AIA Document G703 Continuation Sheet.

1. Copies of AIA standard forms may be obtained from the American Institute of Architects; http://www.aia.org/contractdocs/purchase/index.htm; docspurchases@aia.org; (800) 942-7732.

END OF DOCUMENT

SECTION 00 60 00
FORMS

1.1 1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:

1. AIA Document A101, "Standard Form of Agreement between Owner and Contractor,Stipulated Sum."

a. The General Conditions for Project are AIA Document A201, "General Conditions of the Contract for Construction."

2. The General Conditions are included in the Project Manual.

3. The Supplementary Conditions for Project are separately prepared and included in the Project Manual.

4. Owner's document(s) bound following this Document.

1.2 ADMINISTRATIVE FORMS

A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.

B. Copies of AIA standard forms may be obtained from the American Institute of Architects; http://www.aia.org/contractdocs/purchase/index.htm; docspurchases@aia.org; (800) 942-7732.

C. Preconstruction Forms:

1. Form of Performance Bond and Labor and Material Bond: AIA Document A312, "Performance Bond and Payment Bond."

2. Form of Certificate of Insurance: AIA Document G715, "Supplemental Attachment for ACORD Certificate of Insurance 25-S."

D. Information and Modification Forms:

1. Form for Requests for Information (RFIs): AIA Document G716, "Request for Information (RFI)."

2. Form of Request for Proposal: AIA Document G709, "Work Changes Proposal Request."

3. Change Order Form: AIA Document G701, "Change Order."

4. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G707, "Architect's Supplemental Instructions."

5. Form of Change Directive: AIA Document G714, "Construction Change Directive."

E. Payment Forms:

1. Schedule of Values Form: AIA Document G703, "Continuation Sheet."

2. Payment Application: AIA Document G702/703, "Application and Certificate for Payment and Continuation Sheet."

3. Form of Contractor's Affidavit: AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."

4. Form of Affidavit of Release of Liens: AIA Document G706A, "Contractor's Affidavit of Payment of Release of Liens."

5. Form of Consent of Surety: AIA Document G707, "Consent of Surety to Final Payment."

END OF DOCUMENT

SECTION 00 72 00
GENERAL CONDITIONS NOTICE

1.01 FORM OF GENERAL CONDITIONS

A. The “General Conditions of the Contract for Construction”, American Institute of Architects’ A.I.A. Document A201, Latest Edition, and “Supplementary Conditions” on file in the offices of the Architect and the Owner’s Supervising Engineer, are hereby a part of these Specifications, and shall apply and be binding to all Contractors as though written in full herein.

B. The Contractors shall be held to have examined and become familiar with all provisions of the above referenced documents.

C. Certain provisions of these standard “General Conditions of the Contract for Construction” have been revised or modified by portions of this “NOTICE” and the “SUPPLEMENTARY CONDITIONS”. In all such cases, the provisions of the “NOTICE” and the “SUPPLEMENTARY CONDITIONS” shall take precedence, to the extent of any conflict or inconsistency, over these standard “General Conditions of the Contract for Construction”.

D. Wherever the word “Owner” appears in such “General Conditions”, and elsewhere in these documents, it shall be interpreted as “County of Hidalgo”, so that the word “Board” is hereby substituted for the word “Owner” throughout these documents.

E. Wherever the word “Contractor” or “Subcontractor” appears in these documents, it shall be interpreted to mean the Contractor who’s Proposal has been accepted for that respective Section of the Work.

1.02 SUPPLEMENTARY CONDITIONS

A. Refer to Section 00 73 00 for amendments to these General Conditions.

END OF SECTION

SECTION 00 73 00
SUPPLEMENTARY CONDITIONS

ARTICLE 1 - GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

The Agreement takes precedence over all other Contract Documents.

1.2 EXECUTION, CORRELATION AND INTENT

No allowance shall subsequently be made on behalf of the Contractor on account of an error on his part or his negligence or failure to acquaint himself with the conditions of the site.

1.2.2.1 Before submitting proposal for this work, each bidder shall be held responsible for having examined the premises and satisfied himself as to the existing conditions under which he will be obliged to operate and that will, in any manner, affect the work under this Contract. No allowance shall be made subsequently in the connection on behalf of the contractor for any error or negligence on his part, nor for slight discrepancies on drawings as to grades, slopes and elevations.

1.2.2.2 In case the bidder finds any discrepancy between the conditions at the site and the requirements of these plans and specifications, he shall notify the Owner in writing before the opening of bids and the Owner will issue the necessary instructions to all bidders.

1.2.2.2.1 In the event of inconsistencies within or between parts of the Contract Documents, or between the Contract Documents and applicable standards, codes, and ordinances, the Contractor shall (1) provide the better quality or greater quantity of Work or (2) comply with the more stringent requirement; either or both in accordance with the Architect's reasonable interpretation. The terms and conditions of this paragraph 1.2.3, however, shall not relieve the Contractor of any obligations set forth in Paragraphs 3.2 and 3.7. Before ordering any materials or doing any Work, the Contractor and each Subcontractor shall verify measurements at the Project site and shall be responsible for the correctness of such measurements. Any difference, which may be found, shall be submitted to the Architect for resolution before proceeding with the Work.

Add the following to Paragraph 1.2.4:

Such separations shall not operate to make the Architect an arbiter to establish subcontract limits.

Add the following after Paragraph 1.2.5:

1.2.6 Titles of Sections and Articles in these Specifications are introduced merely for convenience and are not to be construed as a correct or complete segregation or tabulation of the various units of material and/or work. The Contractor shall be solely responsible for omissions or duplications by the Contractor or any

Subcontractors due to real or alleged error, either direct or implied, in arrangement of matter in the Contract Documents.

1.2.7 Contractor shall check Drawings and Specifications immediately upon their receipt, and shall notify Architect in writing not later than ten (10) days after receipt of them, of errors, discrepancies, or omissions. Contractor shall verify dimensions and details before ordering materials for laying out work and shall be responsible for errors that might have been avoided by such check. Deviations from Drawings and dimensions shall be made only with the Architect's permission. No exchange or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the Drawings. Any difference, which may be found, shall be submitted to the Architect for instructions before proceeding with the work.

1.2.8 Specifications and Drawings are intended to be complementary and in agreement each with the other. All work or materials called for by either shall be Performed and/or furnished as if called for by both. In cases of discrepancy concerning dimensions, quantities, and location, the contractor shall, in writing, call to the attention of the Architect any discrepancies between Specifications, Plans, Details or Schedules. The Architect will then inform the Contractor, in writing, which document takes precedence. Should the Contractor not notify the Architect as per the prior instructions, the greater amount of work, cost and/or materials shall be included in the base bid or alternate bid amount as part of this agreement.

1.2.9 These Specifications are intended to supplement the Drawings, the two being considered cooperative and, therefore, it will not be the province of these Specifications to mention any portion of the construction which the Drawings are competent to explain, and such omission will not relieve the Contractor from carrying out such portions as are only indicated from the Drawings, and should items be required by these Specifications which are not indicated on the Drawings, they are to be supplied.

1.2.10 The Contractor shall supply all labor, materials, transportation, apparatus, light, energy, scaffolding and tools necessary for the entire proper completion of the Work.

1.2.11 Unless specified otherwise, all of the materials incorporated in the work shall be new and of the best of the kind of grades specified and all workmanship be up to the best recognized standard known to the various trades.

1.3.1 The Drawings, Specifications, and other similar or related documents and copies thereof are furnished to the Contractor for the purpose of performing the Work and are, and shall remain, the property of the Architect.

ARTICLE 2 - OWNER

2.2 INFORMATION AND SERVICE REQUIRED OF THE OWNER

A. Architect will furnish Contractor Online Procurement and Contracting Documents: Contact Natanael Perez at nperez@twgarch.com for a download link. Any other questions to be in written/e-mailed format to the attention of Laura Nassri Warren at lwarren@twgarch.com and a copy to Andrina De Anda at andrina@twgarch.com.

2.2.7 OWNER'S RIGHT TO SEPARATE CONTRACT

Although it is contemplated that this Contract shall include all of the work intended to be done at this time, it is possible that the Owner may let other Contract in connection with the work herein specified. In any event, the Owner reserves the right to do so, in which case the Contractor shall afford reasonable opportunity for the storage of materials and the execution of work by others.

ARTICLE 3 - CONTRACTOR

3.2 VIEW OF CONTRACT DOCUMENTS

3.2.1 Contractor shall carefully study and compare the Agreement, Conditions of the Contract, Drawings, Specifications, Addenda and Modifications and shall at once report, in writing, to the Architect any error, inconsistency or omission he may discover. Contractor shall be liable for any damage to Owner for failure to so report any error, inconsistency or omission he may discover or should have discovered, but he shall not be liable to Owner or Architect for any damage resulting from any such error, inconsistency or omission he should not have discovered or which he did discover and at once so reported. Contractor shall do no work without approved Drawings and Specifications.

3.2.4 Should the Specifications and Drawings fail to particularly describe the material or kind of goods to be used in any place, then it shall be the duty of the Contractor to make inquiry of the Architect as to what is best-suited. The material that would normally be used in this place to produce first quality finished Work shall be considered a part of the Contract.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.5 In laying out the work, the Contractor shall verify all measurements and dimensions and shall immediately report any errors to the Architect. The Contractor shall employ an experienced and competent instrument person to lay out the structure and establish a permanent and accessible bench mark from which the grades may be established and checked from time to time during the progress of the work. Contractors shall lay out building corners accurately and secure approval of the Architect before proceeding with excavation.

3.4 LABOR AND MATERIALS

3.4.1.1 Not later than ten (10) days from the Contract Date, the Contractor shall provide a list of the names of the manufacturers proposed to be used for each of the following products listed in the Instruction to Bidders and, where applicable, the name of the installing subcontractor. The Architect will promptly reply in writing to the Contractor stating whether the Owner or the Architect have any reasonable objection to any such proposal. If adequate data on any proposed manufacturer or installer is not available, the Architect may state that action will be deferred until the Contractor provides further data. Failure of the Owner or the Architect to reply promptly shall not constitute a waiver of any of the requirements of the Contract Documents and all products furnished by the listed manufacturer must conform thereto.

3.4.1.2 Products are generally specified by ASTM and other reference standard, and/or by manufacturer's name and model number or trade name. When specified only by reference standard, the Contractor may select any product meeting this standard, by any manufacturer. When several products or manufacturers are specified as being equally acceptable, the Contractor has the option of using any product and manufacturer combination listed, but may not substitute others except as provided in Paragraph 4.4.1.3 below. When only one product and manufacturer is Specified, this is the basis of the Contract, without substitution or exception.

3.4.1.3 After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products in place of those specified, under the following conditions:

The request complies with requirements of Section 012500 and additionally complies with the following:

The request is accompanied by complete data on the proposed substitution substantiating compliance with the Contract Documents including product identification and description, performance and test data, references and samples where applicable, and an itemized comparison of the proposed substitution with the products specified with data relating to Contract time schedule, design and artistic effect where applicable, and its relationship to any separate contracts."

The request is accompanied by accurate cost data on the proposed substitution with the product specified, whether or not modification of the Contract sum is to be a consideration.

3.4.1.4 By making requests for substitutions based on Paragraph 3.4.1.3 above, when forwarded by the Contractor to the Architect, the Contractor:

Represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified. Will provide the same guarantee for the substitution that he would for that specified.

Certifies that the cost data presented is complete and includes all related costs under this Contract, but excludes costs under any separate contracts and the Architect's redesign costs, and that he waives all claims for additional costs related to the substitution which subsequently become apparent.

Will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

States that the proposed substitution is in full compliance with the Contract Documents and applicable codes.

Will provide a list of other trades, (if any), which may be affected by the substitution. Shall be responsible for any effect upon related work in the Project of any substitution and shall pay any additional costs generated by any substitutions.

3.4.1.5 Substitutions will not be considered if:

They are indicated or implied on Shop Drawings, Product Data or Sample submissions without the formal request required in paragraph 3.4.1.3 above.

For their implementation, they require a substantial revision of the Contract Documents or work of the owner or separate Contractors in order to accommodate their use.

3.4.4 After the Contract has been executed, the owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth herein and in the Contract Documents. By making request for substitution, the Contractor (a) represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified; (b) represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified; (c) certifies that the cost data presented is complete and includes all related costs under this Contract but excludes cost under separate contracts and excludes the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and (d) will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

3.5 WARRANTY

3.5.2 Guarantees:

Contractor shall guarantee all work performed under this Contract as specified, delivering written guarantees to Owner, through Architect, upon completion in accordance with Section 01700.

For the convenience of the General Contractor, the following is a summary including, but not limited to, releases, warranties, and the guarantees mentioned in the various Section of these Specifications to be furnished to the Owner, through the Architect, upon completion of the Project. Where the requirements

listed herein conflict with those in the various sections of these Specifications, the stricter requirements will take precedence.

General Contractor's notarized affidavit that all bills for labor and materials have been paid in full.

General Contractor's guarantee for ONE YEAR FROM DATE OF FINAL ACCEPTANCE OF THE WORK against defective materials and/or workmanship.

Roofing subcontractor shall furnish a TEN YEAR written certificate guaranteeing that all roofing materials are installed in accordance with Plans and specifications, that all roofing work is free from faulty 'materials and workmanship, that pitch will not leak or drip or stain any part of the building, and providing for repair and replacement of any faulty materials and/or workmanship.

The Flashing subcontractor's guarantee for a period of FIVE YEARS against defective materials and/or workmanship.

Caulking subcontractor's guarantee for a period of TWO YEARS from the date of final acceptance of the work.

Electrical subcontractor's guarantee for a period of ONE YEAR from time his work is accepted, against defective materials and/or workmanship.

All other guarantees not listed above but specified in the technical portion of the Specifications shall be furnished to the Owner upon completion of the Project.

3.5.3 Without limiting any other warranty, the Contractor shall warrant for a period of twelve (12) months that the buildings shall be watertight and leak proof at every point and in every area, except where leaks can be attributed to damage to the building by external forces beyond Contractor's control. The Contractor shall, immediately upon notification by the Owner of water penetration, determine the source of water penetration and, at its own expense, do any work necessary to make the building watertight. Contractor shall also, at its own expense, repair or replace any other damaged material, finishes, and furnishings, damaged as a result of this water penetration, to return the building to its original condition.

ARTICLE 3.6 - TAXES

3.6.2 Bids shall include sales and use taxes. Contractors shall show separately with each monthly payment application the sales and use taxes paid by them and their subcontractors in the form indicated. Reimbursement of sales and use taxes, if any, shall be applied for by Owner for the sole benefit of Owner.

3.7 - PERMITS, FEES AND NOTICES

3.7.5 Upon completion of the work, Contractor shall deliver to the owner through the Architect, all required Certificates of Inspection.

3.7.6 Any reference in the Specifications text to codes, standard specifications or manufacturer's instructions shall mean the latest printed edition of each in effect at the contract date.

3.9 - SUPERINTENDENT

3.9.1 Contractor and his prime subcontractors shall employ competent superintendents and necessary assistants who shall be in attendance at the Project site during the progress of the work. The superintendents shall be satisfactory to the Architect and shall not be changed except with the consent of the Architect, unless the superintendents leave the employ of the Contractor or the prime subcontractor.

3.9.2 At the beginning of Project, Contractor shall submit, in writing, to the Architect the name of his superintendent and the names of the superintendents of his prime subcontractors, this to include a list of past projects on which each superintendent has worked or been in charge of.

3.9.3 Superintendents shall not be removed from the Project by Contractor or his prime subcontractor without written requests and approval by the Architect.

3.9.4 Superintendent shall represent Contractor and all communications given superintendent shall be as binding as if given Contractor. Important communications will be confirmed in writing. Other communications will be so confirmed on written request in each case.

3.10 CONTRACTOR’S CONSTRUCTION SCHEDULE

3.10.3 The progress schedule shall be of a type similar to the CPM, PERT, DYliA-PERT schedules or their equivalent in the opinion of the Architect. The number of activities and structure of the progress schedule shall be adequate to explain the various stages of construction. Completed progress schedule shall be submitted to Architect no later than thirty (30) calendar days after date of Agreement and shall be updated during construction as required to keep it current. Nothing in this requirement shall be deemed to be usurpation of the Contractor's authority and responsibility to plan and schedule the work as he sees fit, subject to all other requirements of the Contract Documents.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.11 Submission of Shop Drawings and Samples to Architect required for ONLY those times specifically mentioned in the Specification Sections. If Contractor submits Shop Drawings for items other than the above, Architect will not be obliged to review them. Contractor shall be responsible or procuring Shop Drawings for his own use as he may require for the progress of the work.

3.12.12 The term "shop drawing" as used herein also includes, but is not limited to, fabrication, erection, layout and setting drawings, manufacturer's standard drawings, descriptive literature, catalogues, brochures, performance and test data, wiring and control diagrams, all other drawings and descriptive data pertaining to materials, equipment or systems and the position thereof conforms

to the Contract requirements. As used herein, the term "manufactured" applied to standard units usually mass produced; and "fabricate" means items specifically assemble or made out of selected materials to meet individual design requirements. Shop Drawings shall establish the actual detail of all manufactured or fabricated items; indicate proper relation to adjoining work; amplify design details or mechanical and electrical equipment in proper relation to physical spaces in the structure; and incorporate minor changes of design or construction to suit actual conditions.

3.12.13 Following Contractor's review and approval, he shall submit to the Architect shop drawings and submittals in the quantities listed in Section 01300. Architect, at Owner's expense, will make prints for himself, Owner and Project Representative and then return the reproducible copy to Contractor in order that as many additional prints may be made, at Contractor's expense, as he may require for the remaining parties concerned.

3.12.14 Manufacturers instructions: Where any item of work is required by specification to be furnished, installed or performed in accordance with a specified product manufacturer's instructions, contractor shall procure and distribute the necessary copies of such instructions to all concerned parties.

3.12.15 Materials in the Specifications may be followed by the words "or as approved by the Architect". In these cases, wherever the name or brand of a manufacturer's article is specified, it is used as a measure of quality and utility or a standard. If Contractor desires to use any other brand or manufacturer of same quality, appearance and utility to that specified, he shall request substitution as provided in paragraph 4.4.

3.13 USE OF THE SITE

3.13.2 The Contractor shall arrange and maintain material and equipment in orderly manner keeping walks, drives, roads and entrances unencumbered.

3.15 CLEANING UP

3.15.3 Besides the "broom cleaning", the following special cleaning is required just prior to acceptance:
Remove stains; wash and polish glass, inside and outside. This work shall be done by persons skilled and equipped for such work.

Remove foreign matter, marks, stains, foreign paint, fingerprints, soil and dirt from (and have in a polished condition where appropriate) the following:
Painted, decorated and stained work.

All hardware, fixtures and incorporated equipment.

All finished surface and metal surfaces, whether interior or exterior.

All doors and windows.

3.15.4 In addition to clean-up provisions of the Specifications, Contractor shall take appropriate steps to prevent air-borne dust due to work under this contract.

Water shall be applied wherever practical to settle and hold dust to a minimum, particularly during the excavation and moving of materials.

3.18 INDEMNIFICATION

3.18.3 The obligations of the Contractor under this paragraph 3.18.3 shall not extend to the liability of the Architect, his agents or employees arising out of (1) the preparation of approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications or (2) the giving of direction or instructions by the Architect, his agents or employees provided such giving is the primary cause of the injury or damage.

ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

4.2 ARCHITECT'S ADMINISTRATION OF THE CONTRACT

The term 'aesthetic effect' as used herein refers to color, texture, profile and juxtaposition of masses. The Architect shall be the sole interpreter of the design intent with respect to such matters, but the Architect's authority with respect thereto shall not contravene any other rights of either the Owner or the Contractor ascribed to them by other provisions of the Contract.

ARTICLE 5 - SUBCONTRACTORS

5.5 No subcontractor shall be let until the list of proposed subcontractors as submitted at the bid opening is approved, in writing, by the Owner.

5.6 The General Contractor shall bind all Subcontractors, the Mechanical Contractor and the Electrical Contractor to the terms of the Contract Documents.

5.7 The General Contractor agrees that he is as fully responsible to the Owner or the acts and omissions of his Subcontractors and of persons either directly or indirectly employed by them as he is for the acts and omissions of persons directly employed by him.

5.8 Nothing contained in the Contract Documents shall create any contractual relations between any Subcontractor and the owner.

ARTICLE 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.2 MUTUAL RESPONSIBILITY

6.2.7 Contractor shall be responsible for the proper fitting of all work and for the coordination of the operations of the trades, other contractors, subcontractors, and material suppliers engaged upon or in connection with the work as well as those of his own employees, and he shall exercise every effort to assure a harmonious cooperative working relationship on the part of all concerned. He shall be prepared to guarantee to each of his subcontractors and foremen all of the dimensions which they may require for the fitting of their own to adjoining work and shall do or shall cause his agents to do, all fitting and adjusting necessary to make the several parts of the work come together properly and fit the work to receive or be received by, the work of other Contractors.

ARTICLE 7 - CHANGES IN THE WORK

7.2 CHANGE ORDERS

7.2.2 Any adjustment to contract sum shall be determined by methods described in 7.3.3, 7.3.10 and 7.3.11.

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.3.5 In subparagraphs 7.3.3.1 and 7.3.3.3 the allowance for overhead and profit combined, included in the total cost to the Owner shall be based on the schedule in the Bid Form.

7.3.6 In allowance for overhead and profit in accordance with the schedule the Contractor is to provide – “In the Bid Form.”

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

7.3.11 In order to facilitate checking of quotations for extras or credit, all proposals, except those so minor that their property can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and subcontractors. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are subcontracts, they shall be itemized also. In no case will a change involving over $100.00 be approved without such itemization. Every change itemization shall be submitted on attached Change in work/Cost Analysis forms.

ARTICLE 8 - TIME

8.1 DEFINITIONS

8.1.5 Contract Time commences at the time of Notice to Proceed.

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.4 Contractor shall have all materials delivered at the site in such quantities as required for the uninterrupted progress of the work and the least obstruction of the premises and the adjoining property. No extension of time or extra cost will be allowed for failure by Contractor to order the material on time or in insufficient quantities.

WEATHER DELAY

8.3.5 For the purpose of calculating extensions of time due to inclement weather, the attached local climatological data will be used.

8.3.6 Unless the Owner considers that unusual circumstances warrant consideration, extensions of time because of inclement weather will be granted for any work only to the extent that the number of days of precipitation (.04" or more) and/or

the number of days of freezing weather (32 degrees and below) exceeds the mean for that month; provided that no one day will be counted more than once; and provided further, that if a day lost because of weather falls immediately before a non working day or days, such as a holiday or weekend, such working days shall be considered as lost time. The mean number of days of Precipitation and freezing weather shall be established by the tabulation of normals, means and extremes published by National Oceanic and Atmospheric Administration in the most recent Local Climatological Data for the closest reporting station to the site of the work. No claim will be considered unless it is accompanied by the attached "Time Extension Request" form completed within two weeks of the time referenced inclement period.

LIQUIDATED DAMAGES

For each day after Substantial Completion that the work remains incomplete, a penalty of $1,000.00 per day will be charged to the Contractor.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

9.1.2 All costs of overtime work require by the nature of this work, except emergencies as covered in Article 10.3.1 shall be included in the Bid.

9.3 APPLICATIONS FOR PAYMENTS

9.3.1 In each Application for Payment, the Contractor shall certify that such Application for Payment represents a just estimate of cost reimbursable to the Contractor and also shall certify as follows:

(a) There are no known mechanic's or materialmen's liens outstanding at the date of this requisition, that all due and payable bills with respect to the Work have been paid to date or are included in the amount requested in the current application, and that, except for such bills not paid but so included, there is no known basis for the filing of any mechanic's or materialmen's liens on the Work, and that waivers from all Subcontractors and materialmen's have been obtained in such form as to constitute an effective waiver of lien under the laws of the location of the Project.

(b) The Contractor shall within thirty (30) days of receipt of notice of the existence of any lien filed against the Project by any subcontractor, supplier of materials or any other person or entity claiming to be a creditor of the Contractor, cause the same to be removed as of record or provide a bond to indemnify or a cash deposit to the Title Company in an amount equal to the lien.

9.3.1.3 Along with the Progress Schedule, specified herein before, Contractor shall submit to Architect a schedule of the anticipated amount of each monthly payment that will become due the Contractor in accordance with the Progress Schedule. On or about the tenth of each month, the Owner agrees to pay to the Contractor an amount to be determined by taking

ninety percent (90%) of the value of labor and materials incorporated in the work, plus material not incorporated in the work, but approved by the Architect under the provisions of the Contract Documents, up to the date of payment proposed to be made, less the aggregate of all previous payments and deductions provided for in the Contract Documents.

The ten percent (10%) retention shall be paid thirty-five (35) calendar days after the date of recording by the Owner of the Notice Completion of all the work to be done under this contract, providing there are no undercharged or unsecured liens, attachments or claims in connection with the work.

9.3.2 Payments made on account of materials not incorporated in the work shall only be made on material which has been worked to a special design according to the Drawings and specifications. No payment shall be made on standard manufactured items. The Architect's decision as to which category a specific item qualifies under shall be final.

9.8 SUBSTANTIAL COMPLETION

9.8.1 Substantial Completion. Revise to City of McAllen, Texas.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.8 Protection of Plant Life: Solvents, oils and any other material which may be harmful to plant life shall be disposed of in containers as directed by the Architect and removed from the site. At completion of work, any contaminated soil shall be removed and replaced with good soil by this Contractor at no expense to the Owner.

10.2.9 The Contractor shall secure and pay for all necessary permits and shall comply with all ordinances pertaining to his work. He shall provide and maintain suitable temporary walkways, where needed, fences and other structures required by law and city ordinances in such a manner as not to interfere with traffic in public streets. He shall leave access to fire hydrants and protect the public and adjacent property at all times during the progress of the Contract. The proper signs shall be posted at truck entrances, and all other possible safety precautions observed.

10.2.10 The Contractor shall, as a cost of the Work, provide and maintain in good order, any firefighting equipment required by local authorities during Contract operations.

10.2.11 The Contractor shall immediately report to the Owner all accidents arising out of the Work and involving injury to employees of the Contractor, any member of the public or property damage to the property. The Owner's liability insurance will not be responsible for claims, accidents and losses arising out of the Contractor's operations.

ARTICLE 11 - INSURANCE AND BONDS

11.1 CONTRACTORS LIABILITY INSURANCE

11.1.1.8 The liability insurance required shall be on a comprehensive basis, including:

Premises - Operations

Independent Contractor's Protective

Products and Completed Operations.

Add the following to Paragraph 11.1.2:

1. Workmen's Compensation - Statutory
   Employer's Liability - $100,000 per occurrence.

2. Comprehensive General Liability (Public Liability)

   a. Bodily injury - $ 1,000,000 each occurrence.

   b. Personal injury - $ 1,000,000 each person,
   $ 1,000,000 aggregate.

   c. Property damage - $ 1,000,000 each person,
   $ 1,000,000 each occurrence,
   $ 1,000,000 aggregate.

3. Automobile Liability:

   a. Bodily injury - $ 1,000,000 each person,
   $ 1,000,000 each occurrence,

   b. Property damage - $ 1,000,000 each occurrence.

4. Independent Contractors: Same limits as above.

5. Products and Completed Operations: same limits as above for one year, commencing with issuance of the Final Certificate for Payment.

6. Contractual Liability: Same limits as above.

7. Umbrella Liability: Excess over underlying limits above $ 1,000,000.

8. Builder's All Risk: The Contractor shall provide and maintain Builder's All Risk Insurance with minimum coverage consisting of fire, extended coverage, vandalism and malicious protection sufficient to amply indemnify himself, the Owner and the Architect against loss or damage that may occur to the premises and improvements supplied by the Contractor until final completion and acceptance by the Owner.

11.1.3.1 Furnish one copy of the Certificates herein required for each copy of the Agreement; specifically set forth evidence of all coverage required by paragraphs 11.1.1 and 11.1.2. The form of the Certificate shall be AIA Document G705. Furnish the owner copies of any endorsements that are subsequently issued amending.

11.4 PERFORMANCE BOND AND PAYMENT BOND

Both a Performance Bond and a Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum.

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

12.2 CORRECTION OF WORK

Add the following to Paragraph 12.2.2:

The above stated ONE YEAR guarantee by the General Contractor may be extended to longer periods if stated in the Specific Section of the Specifications".

Substitute "Date of Final Acceptance of the Project" in lieu of "Date of Substantial Completion" or "Substantial Completion". The date of Final Acceptance shall be the date of the Final Application of Payment is approved by the Architect.

12.3 ACCEPTANCE OF DEFECTIVE OR NON-CONFORMING WORK

Add the following after Paragraph 12.3.1:

"Appropriate reduction" is hereby defined as an amount equal to the entire cost of replacing the work to make it as originally shown or specified.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.1 AHERA

Pursuant to Federal Public Law 99-519, otherwise known as the Asbestos Hazard Emergency Response Act (AHERA) there shall be no asbestos containing products and/or materials used in this project.

OTHER CONDITIONS OR PROVISIONS

Contractor understands and agrees that time is of the essence hereof and in order to comply with Article 3 and meet all applicable completion dates, Contractor warrants and represents that Contractor will undertake proper coordination of the Work so as to not interfere, disrupt, delay or adversely affect in any way the on-going business functions and operations of the owner. Contractor understands and agrees that in order to comply herewith, it may be necessary for work to continue under this Contract on holidays, weekends and other calendar days on which Work is not ordinarily performed; cost of which shall be by the Contractor.

All risk insurance described in Article 11, Section 11.3.1.1 shall be purchased and carried by the contractor. The additional cost for this insurance will be paid by the Owner.

The term Products is utilized throughout this Specification Manual to encompass the many other words often used in specifications they are defined in the paragraph below:

1. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

2. Furnish or Supply: To supply and deliver, unload, inspect for damage.

3. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, and ready for use.

4. Provide: To furnish or supply, plus install.

END OF DOCUMENT

SECTION 01 01 00
GENERAL SCOPE OF WORK

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: The Project generally consists of, but is not necessarily limited to, the following:

1. Project consists of a new Building Facility as follows:
Approximate Building Gross Area 16,504 S.F.

1. Site Work as noted in the Construction Documents.

B. Work Not Included, must meet Requirements:

1. Furnishings.

2. All Items Noted “N.I.C.” (Not In Contract) on Drawings.

1.02 CONTRACT DOCUMENTS

A. Requirements for all Work shall be executed in strict accordance with the following:

1. The Contract.

2. The Drawings.

3. The Approved Shop Drawings.

4. The General Conditions and Supplementary General Conditions.

5. The Specifications, Addenda and Bulletins.

6. The Change Orders and Directives received from the Owner and/or Architect.

7. Warranties and Guarantees in accordance with requirements of the Contract Documents, with period of Warranty as stated therein; except if Contractor neglects to correct or complete Work in Punch Lists during period of Warranty and/or Guaranty, Contractor is still responsible and required to do so after expiration dates of Warranty or Guaranty until the corrective Work is completed and accepted by the Owner.

8. The governing Building Code, all governing laws, ordinances, rules, permits, regulations and directives from governing authorities having jurisdiction over this Work.

9. The approved Construction Time and Sequence Schedule.

10. Cooperation with other Contractors employed on the Project by the Owner under separate contracts. Cooperation shall include, but not be limited to, written notices to others when required to implement proper coordination of the Work and to maintain the Construction Time and Sequence Schedule.

B. Intent of Contract Documents: Work not particularly detailed, marked, or specified shall be the same as similar parts that are detailed, marked, or specified. Should an error occur in the Specifications or Drawings, or in Work by others affecting this Work, the Contractor shall at once notify the Architect who will issue instructions as to procedure. If the Contractor proceeds with the Work based on such an error without instructions from the Owner, the Contractor shall make good any resulting damage or defects. This includes Specification typographical errors and Drawing notational errors where the intent is doubtful.

C. Conflicts: In the event of a conflict or need for interpretation between the Working Drawings and Specifications, the Architect shall be the sole interpreter of the Drawings and Specifications, to determine which, if any will take precedence.

D. Requirements of Regulatory Agencies: Furnish and install materials in strict compliance with the laws, codes, ordinances and regulations of the public authorities having jurisdiction over this Project, including “ICC/ANSI - A117.1 - Standard for Accessible and Usable Buildings and Facilities” and “Title III of The Americans with Disabilities Act (ADA), Public Law 101-336”.

1.03 QUALITY ASSURANCE

A. Standards: All exterior building materials and systems shall meet local building code requirements for fire spread, uplift resistance, and wind loads.

1.04 PROHIBITED SUSPENSION OF MATERIALS FROM METAL DECK

A. Suspension of any material or equipment from metal deck is strictly prohibited. Items not allowed to be attached to or suspended from the metal deck include but are not limited to mechanical or electrical equipment, ducts, piping, light fixtures, or other decorative structures.

1.05 HAZARDOUS MATERIALS

A. The building shall be free of hazardous materials according to applicable federal, state, and local environmental regulations.

1.06 ASBESTOS FREE MATERIALS

A. No asbestos, or products containing asbestos, shall be installed in this Project. General Contractor shall provide to the Owner at completion of construction, an affidavit certifying that the Project is free of all asbestos - containing materials.

1.07 ACCESS TO SITE

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

1.08 WORK RESTRICTIONS

A. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor air intakes.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 15 00
CONTRACT STANDARDS AND PROCEDURES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: This section consists of establishing standards and procedures.

1.02 OPERATIONS

A. Layout: Locate and layout the Work, and establish lines and levels accurately. Report any discrepancies to the Architect immediately upon discovery.

B. Use of Premises: Confine apparatus, storage of materials, and operations of workmen to limits indicated by law, ordinance, permit, or arrangement with the Owner. Do not unreasonably encumber the premises with materials.

C. Project Meetings:

1. Progress Meetings: Schedule and conduct regular periodic progress meetings. All Key personnel of contractor and subcontractors shall attend. Notify other parties as the Owner’s Representative or Architect might designate, as job conditions and progress might warrant.

a. Contractor’s Construction Schedule: Review progress since last meeting, determine whether each activity is on time, ahead schedule, or behind schedule, in relation to the 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 correct and subsequent activities will be completed within Contract Time.

1) Review schedule for next scheduled progress meeting period.

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

1) Interface requirement.

2) Sequence of operations.

3) Status of submittals.

4) Deliveries.

5) Off-site fabrication.

6) Access and site utilization.

7) Temporary facilities and controls.

8) Progress Cleaning

9) Quality and work standards

10) Status of correction of deficient items.

11) Field observations.

12) Status of RFIs.

13) Status of proposal requests.

14) Pending changes and Status of Change Orders.

15) Pending claims and disputes.

16) Documentation of information for payment requests.

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

2. Pre-construction Meeting: Schedule and conduct a preconstruction meeting before starting construction, at a time convenient to Owner and Architect, but no later than 10 days after execution of the Agreement. All Key personnel of owner, design professionals and contractors shall attend. Notify other parties as the Owner's Representative or Architect might designate, as job conditions and progress might warrant.

a. Agenda: Discuss items of significance that could affect progress, including the following:

1) Tentative construction schedule.

2) Phasing and Staging.

3) Critical work sequencing and long-lead items.

4) Designation of key personnel and their duties.

5) Lines of communications.

6) Procedures for processing field decisions and Change Orders.

7) Procedures for RFIs.

8) Procedures for testing and inspecting.

9) Procedures for processing Application for Payment.

10) Distribution of the Contract Documents.

11) Submittal procedures.

12) Preparation of record documents.

13) Use of the premises.

14) Work restrictions.

15) Working hours.

16) Owner's occupancy requirements.

17) Responsibility for temporary facilities and controls.

18) Procedures for moisture and mold control.

19) Procedures for disruptions and shutdowns.

20) Construction waste management and recycling.

21) Parking Availability.

22) Office, work, and storage areas.

23) Equipment deliveries and priorities.

24) First Aid.

25) Security.

26) Progress cleaning.

27) Safety.

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

4. Pre-installation Meetings: Conduct a preinstallation meeting at Project site before each construction activity that requires coordination with other construction. All Key personnel of contractor, subcontractors, manufacturer representative and Owner's Commissioning Authority shall attend. Notify other parties as the Owner's Representative or Architect might designate, as job conditions and progress might warrant.

a. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

1) Contract Documents.

2) Options.

3) Related RFIs.

4) Related Change Orders.

5) Purchases and Deliveries.

6) Submittals.

7) Review of Mockups.

8) Possible conflicts and Compatibility problems.

9) Time schedules and weather limitations.

10) Manufacturer's written recommendations.

11) Warranty requirements.

12) Compatibility of materials and acceptability of substrates.

13) Temporary facilities and controls.

14) Space and access limitations.

15) Regulations of authorities having jurisdiction.

16) Testing and inspecting requirements.

17) Installation procedures and coordination with other work.

18) Required performance results.

19) Protection of adjacent work, construction and personnel.

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

5. Project Closeout Meetings: Schedule and conduct a Project closeout meeting, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion. All Key personnel of contractor, subcontractors, owner, owner's commissioning authority and design professionals shall attend. Notify other parties as the Owner's Representative or Architect might designate, as job conditions and progress might warrant.

a. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

1) Submission of record documents.

2) Procedures required prior to inspection for Substantial Completion and for Final inspections for acceptance.

3) Submittal of written warranties.

4) Requirements for preparing operations and maintenance data.

5) Requirements for demonstrations and training.

6) Preparation of Contractor's punch list.

7) Procedures for processing Applications for Payment at Substantial Completion and for final payment.

8) Submittal Procedures.

9) Coordination of separate contracts.

10) Owner's partial occupancy requirements.

11) Installation of Owner's furniture, fixtures, and equipment.

12) Responsibility for removing temporary facilities and controls.

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

1.03 RECORDS

A. Record Drawings: Maintain on site a complete set of Construction Documents and Shop Drawings as required by Section 01 70 00 - Project Closeout.

B. Construction Photographs: Refer to Sections 01 32 33 - Photographic Documentation.

1.04 SUBMITTALS

A. Subcontractor List: Submit list of subcontractors with addresses, telephone numbers and e-mail addresses for approval within twenty-four (24) hours after notification of intent to enter into Contract. Prepare list on the form of a sworn statement attesting to the validity of such. Do not change the name of subcontractors or vendors on the approved list without the specific written form stating sufficient reason to warrant such a change.

B. Schedule of Values: Prepare detailed accounting of Contract Sum on the basis of "trades" Sections indicated in the Table of Contents. Submit and obtain approval before first application for payment. Use only approved breakdown for payment requests.

C. Payment Schedule: Submit to the Architect at least twenty (20) days prior to the submission of the first request for payment, a schedule detailing projected monthly requests for payment for the duration of the Project.

D. Shop Drawings and Samples:

1. Refer to Section 01 33 23 - Shop Drawings and Samples.

2. In addition to Section 01 33 23, the Contractor shall furnish the Owner with one (1) copy of all approved Shop Drawings and manufacturers product data bound in loose leaf form, for the Owner's records, prior to Owner issuing the Certificate of Substantial Completion.

E. Test Reports: Submit copies as required herein, with distribution as directed by the Architect.

1.05 DOCUMENTS

A. Performance and Labor and Material Payment Bonds:

1. If required, deliver to the Owner within ten (10) days of the date of the notification of intent to enter into Contract.

2. Condition bonds for the faithful performances of the Contract and for the payment of labor and material, each in the sum of 100% of the amount of the Contract as set forth in notification of intent to enter into Contract.

3. The Owner, at the Owner's discretion, reserves the right to accept or reject the company underwriting the bonds on the basis of their previous performance.

B. Agreement: Use AIA Form A111.

C. Application for Payment: Use AIA Form G702 and G703.

D. Sworn Statements: Use uniform commercial format designated by the Owner.

E. Insurance Certificate: Use form selected by Owner. Owner may, at the Owner's option, require a certified copy of Contractor's insurance policies in addition to insurance certificates.

1.06 QUALITY CONTROL

A. Standards: Establish a quality control system to perform sufficient inspection and tests of all Work, including subcontractors, to ensure conformance to applicable Specifications and Drawings, with respect to materials, workmanship, construction, finish, functional performance, and identification. Control system shall specifically include observation, supervision, and tests required in the Specifications.

B. Testing: Provide testing in accordance with Section 01 45 23 - Testing and Inspecting Services.

1.07 SCHEDULE

A. Dates: Work shall commence and be substantially completed as specified in the Contract Agreement.

B. Schedule:

1. Prepare a “Plan of Operations and Progress Schedule” to indicate the manner in which different phases of the Work are to be started, when Shop Drawings and submittals are to be submitted, colors selected, methods and speed for progressing different phase actions, and dates upon which subcontractors are dependent upon other sub-contracts. Schedule shall indicate major items of Work, including foundations, column footings, steel erection, floor finishes, underfloor plumbing and electrical Work, roof mounted HVAC equipment, concrete floor pours, partition Work, and date of Final Completion.

2. Plan of Operations and Progress Schedule shall be “weighted” to schedule each trade in proportion to the entire Project, physically and financially.

3. Revise schedule monthly to indicate actual progress compared to the estimated progress.

4. Post schedule in the Contractor’s field office and distribute copies to the Owner, Architect, Project Representative, and all prime Subcontractors.

1.09 PAYMENT

A. Requests:

1. On or before the tenth (10th) day of each month, the Contractor shall make application for payment in quadruplicate based on percentage of completion of items of cost breakdown.

2. Each application after the first one shall be accompanied by waivers of lien and sworn statements that all labor, materials, and services included in the previous and prior statements have been paid, less only the retained percentage stated herein, and any disputed amounts which shall be stated. In addition, the Contractor shall request and file with the request for payment a sworn statement from each Subcontractor that the Contractor has direct contractual relations with.

B. Payment: The Owner shall make payments on account of each contract as provided herein. Within thirty (30) days after submission and approval of the application for payment the Owner will pay ninety (90) percent of the value except as may be modified as follows, based on the Contract prices, including executed change orders amending the Contract, on labor and materials incorporated in the Work, and material suitably stored at the site up to the first day of that month as certified by the Architect, less the aggregate of the previous payments.

C. Retained Percentage:

1. Ten (10) percent of the estimated amounts shall be retained until the final completion and acceptance of all Work covered by the Contract.

2. The retained percentage shall be paid thirty (30) days after Owner's acceptance of the building, providing that all requirements of the Contract are met. Refer to Closing Procedure.

D. Substantial Completion Payment: Upon issuance of Certificate of Substantial Completion, a sum shall be paid sufficient to increase the payments to the total of the Contract, less the retained percentage.

E. Final Certificate:

1. After the Contractor has complied with the closing requirements specified herein, and provided the Architect with appropriate documentation, the Architect shall certify such, issuing a Final Certificate.

2. Issuance of such Certificate does not relieve the Contractor of the responsibilities related to guaranteeing the performance of the facility, as specified herein or otherwise provided.

1.10 CLEANING

A. Keep the premises free from accumulation of waste materials or rubbish caused by Work operations at all times. At the completion of the Work remove all waste materials and rubbish from and about the Project, as well as all tools, construction equipment, machinery, and surplus materials.

B. Establish and enforce a daily system for collecting and disposing waste materials from construction areas and elsewhere at Project site. Do not hold collected materials at site for more than three (3) days. Handle hazardous, dangerous, unsanitary, contaminating, pollution and similar harmful wastes separately from inert materials by containerizing in an appropriate manner. Dispose of each category of waste material in a lawful manner. Do not bury or burn waste materials on Owner's property.

1.10 CLOSING PROCEDURES

A. Financial:

1. Furnish ample evidence to Architect and Owner that all financial obligations have been met, including sworn statements and final waivers of lien.

2. Obtain a written statement releasing the Owner and the Architect from any and all obligations which might arise out of any unpaid, defaulted, or otherwise unsatisfied accounts.

B. Punch List:

1. Complete and correct all items on the Punch List as originally issued, and amended.

2. If contemplating application for final payment, schedule a joint inspection visit to the Project with the Architect one (1) week in advance to determine if the Contracts have been fully executed.

C. Record Drawings: Deliver not less than three (3) sets of documents to the office of the Architect.

D. Warranties and Guarantees:

1. Submit all written warranties and guarantees.

2. Submit as applicable, list of contacts, including company name, personal contact, address, telephone number, and e-mail address for building equipment and components which may require periodic service, including roofing, power actuated doors, mechanical equipment, fire protection, plumbing, and electrical equipment.

C. Other Documents:

1. Furnish reports of all tests and the performance of completed systems, as required in the Specifications, and all certificates of approval.

2. Furnish all schedules, instructions, and equipment operation and service manuals as necessary to ensure safe and proper operation and maintenance of products installed in the building.

E. Final Certificate: Issuance of Final Certificate does not relieve the Contractors of the responsibilities related to warranting and guarantying the performance of the Work.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2. SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 012300 "Alternates" for products selected under an alternate.

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

1.3 DEFINITIONS

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

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

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

1. Substitution Request Form: Use Industry Standard Form.

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

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

e. Samples, where applicable or requested.

f. Certificates and qualification data, where applicable or requested.

g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

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

i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES, NFPA, end related codes adopted by the City of McAllen.

j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

k. Cost information, including a proposal of change, if any, in the Contract Sum.

l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in

substitution request, is compatible with related materials, and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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

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

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

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

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

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

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

b. Substitution request is fully documented and properly submitted.

c. Requested substitution will not adversely affect Contractor's construction schedule.

d. Requested substitution has received necessary approvals of authorities having jurisdiction.

e. Requested substitution is compatible with other portions of the Work.

f. Requested substitution has been coordinated with other portions of the Work.

g. Requested substitution provides specified warranty.

h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed unless otherwise indicated.

C. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

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

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

b. Requested substitution does not require extensive revisions to the Contract Documents.

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

d. Substitution request is fully documented and properly submitted.

e. Requested substitution will not adversely affect Contractor's construction schedule.

f. Requested substitution has received necessary approvals of authorities having jurisdiction.

g. Requested substitution is compatible with other portions of the Work.

h. Requested substitution has been coordinated with other portions of the Work.

i. Requested substitution provides specified warranty.

j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

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

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

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

2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide subschedules showing values coordinated with the scope of each design services contract as described in Section 010100 "General Scope of Work."

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

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

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

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

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

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
10. 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.

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

1.5 APPLICATIONS FOR PAYMENT

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

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

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

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

D. Application for Payment Forms: Use forms acceptable to Architect and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.

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

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

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

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

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

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

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or proceeded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.

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

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

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

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

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. General coordination procedures.

2. Coordination drawings.

3. Requests for Information (RFIs).

4. Project Web site.

5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1. Section 011500 "Contract Standards and Procedures" for preparing and submitting Contractor's construction schedule.

2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

3. Section 017000 "Project Closeout" for coordinating closeout of the Contract.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

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

1. Name, address, and telephone number of entity performing subcontract or supplying products.

2. Number and title of related Specification Section(s) covered by subcontract.

3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 10 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with 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 performance and accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

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

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

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

1. Preparation of Contractor's construction schedule.

2. Preparation of the schedule of values.

3. Installation and removal of temporary facilities and controls.

4. Delivery and processing of submittals.

5. Progress meetings.

6. Preinstallation conferences.

7. Project closeout activities.

8. Startup and adjustment of systems.

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

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

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

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

    a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

    b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.

    c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

    d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

    e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.

    f. Indicate required installation sequences.

    g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.

2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.

    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.

    c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.

    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.

    c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    d. Location of pull boxes and junction boxes dimensioned from column center lines.

8. Fire-Protection System: Show the following:

    a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient,

Architect will so inform Contractor, who shall make changes as directed and resubmit.

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

1.7 REQUESTS FOR INFORMATION (RFIs)

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

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

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

1. Project name.

2. Project number.

3. Date.

4. Name of Contractor.

5. Name of Architect and Construction Manager.

6. RFI number, numbered sequentially.

7. RFI subject.

8. Specification Section number and title and related paragraphs, as appropriate.

9. Drawing number and detail references, as appropriate.

10. Field dimensions and conditions, as appropriate.

11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

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

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

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.

    b. Requests for approval of substitutions.

    c. Requests for approval of Contractor's means and methods.

    d. Requests for coordination information already indicated in the Contract Documents.

    e. Requests for adjustments in the Contract Time or the Contract Sum.

    f. Requests for interpretation of Architect's actions on submittals.

    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

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

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly Include the following:

1. Project name.

2. Name and address of Contractor.

3. Name and address of Architect and Construction Manager.

4. RFI number including RFIs that were returned without action or withdrawn.

5. RFI description.

6. Date the RFI was submitted.

7. Date Architect's and Construction Manager's response was received.

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

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

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

1.8 PROJECT WEB SITE

A. Use Architect's Project Web site for purposes of hosting and managing project communication and documentation until Final Completion when file size surpasses e-mail max attachment limit, and when otherwise directed by Architect.

B. Contractor, subcontractors, and other parties granted access by Contractor to Project Web site shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 33
PHOTOGRAPHIC DOCUMENTATION

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the specifications.

PART 1 - GENERAL

1.01 SCOPE

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

1. Preconstruction photographs.

2. Periodic construction photographs.

3. Final Completion construction photographs.

1.02 SUBMITTALS

A. Construction Photographs: Submit digital photographs 14 days of taking photographs and digital copies with the monthly application for payment.

1. Format: 3x5 inch smooth-surface matte prints on single-weight commercial-grade photographic paper, enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.

2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:

a. Name of Project.

b. Name and address of photographer.

c. Name of Architect.

d. Name of Contractor.

e. Date photograph was taken if not date stamped by camera.

f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

g. Unique sequential identifier.

3. Digital Images: Submit a complete set of digital image electronic files with each submittal of prints on CD-ROM. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1024 by 768 pixels.

PART 3 - EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

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

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

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

1. Date and Time: Include date and time in filename for each image.

2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect.

C. Pre-construction Photographs: Before commencement of construction the contractor shall document in digital photographs the project site and surrounding properties, including existing items to remain during construction, from different vantage points.
1. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take color, digital photographs monthly, coinciding with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

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

1. Do not include date stamp.

G. Additional Photographs: Architect may issue requests for additional photographs, in addition to periodic photographs specified.

1. Three days' notice will be given, where feasible.

2. In emergency situations, take additional photographs within 24 hours of request.

3. Circumstances that could require additional photographs include, but are not limited to, the following:

a. Special events planned at Project site.

b. Immediate follow-up when on-site events result in construction damage or losses.

c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.

d. Substantial Completion of a major phase or component of the Work.

e. Extra record photographs at time of final acceptance.

f. Owner's request for special publicity photographs.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.

1.3 DEFINITIONS

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

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

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

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

1.4 ACTION SUBMITTALS

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

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

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

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

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

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

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

    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Digital Drawing Software Program: The Contract Drawings are available in PDF drawings.
    c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
    d. Digital data drawing files will made available in PDF Format.

e. The following digital data files will by furnished for each appropriate discipline:

1) Floor plans.
2) Reflected ceiling plans.
3) Digital data file in PDF Format.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

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

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

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Insert list of submittals requiring sequential review in first subparagraph below, or delete and identify submittals in Sections where they are specified. Structural, HVAC, plumbing, and electrical components are examples of the Work that often require sequential review.
6. Allowing procedure in "Concurrent Consultant Review" Subparagraph below may cause tracking problems for Architect and Construction Manager, if any. Delete if not allowed. See Evaluations.
7. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

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

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

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

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

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

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

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

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.

    a. Transmittal Form for Paper Submittals: Use AIA Document G810.
    b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

        1) Project name.
        2) Date.
        3) Destination (To:).
        4) Source (From:).
        5) Name and address of Architect.
        6) Name of Construction Manager.
        7) Name of Contractor.
        8) Name of firm or entity that prepared submittal.
        9) Names of subcontractor, manufacturer, and supplier.

10) Category and type of submittal.
11) Submittal purpose and description.
12) Specification Section number and title.
13) Specification paragraph number or drawing designation and generic name for each of multiple items.
14) Drawing number and detail references, as appropriate.
15) Indication of full or partial submittal.
16) Transmittal number, numbered consecutively.
17) Submittal and transmittal distribution record.
18) Remarks.
19) Signature of transmitter.

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

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

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

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

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

s. Remarks.

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

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

F. Options: Identify options requiring selection by Architect.

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

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

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

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

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

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

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

1. Post electronic submittals as PDF electronic files directly to Architect's FTP site specifically established for Project.

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

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

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

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

    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

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

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

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

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

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

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

    a. PDF electronic file.

b. Three paper copies of Product Data unless otherwise indicated. Architect will return twocopies.

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 based on Architect's digital data drawing files is otherwise permitted.

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

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

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

   a. PDF electronic file.
   b. Two opaque (bond) copies of each submittal. Architect, will return one copy(ies).
   c. Three opaque copies of each submittal. Architect will retain two copies; remainder will be returned.

4. BIM File Incorporation: Develop and incorporate Construction Manager will incorporate Contractor's Shop Drawing files into Building Information Model established for Project.

   a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
   b. Refer to Section 013100 "Project Management and Coordination" for requirements for coordination drawings.

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

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

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

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

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

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

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

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

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

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

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

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

5. Submit product schedule in the following format:

    a. PDF electronic file.
    b. Three paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.

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

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

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

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

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017000 "Project Closeout."

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2.2 DELEGATED-DESIGN SERVICES

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

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

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

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

C. BIM File Incorporation: Construction Manager will incorporate delegated-design drawing and data files into Building Information Model established for Project.

1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

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

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

3.2 ARCHITECT'S ACTION

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

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

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

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

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

END OF SECTION

SECTION 01 33 23
SHOP DRAWINGS AND SAMPLES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SUBMITTALS

A. Summary Listing and Schedule: General Contractor shall prepare a summary listing and schedule for submission of Shop Drawings, Samples, and Product Data to the Architect for review of the various items of Work. Schedule shall allow approximately two (2) calendar weeks or ten (10) working days for review; however, this may vary depending upon the quantity of the material submitted. Schedule shall also allow time for submission of Shop Drawings, Samples, and Brochures which may not be approved.

B. Substitution Requests: Submit a PDF digital copy of each request for consideration. Indentify product or fabrication or installation method to be replaced. Include specification section number and title and drawing numbers and titles.

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

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

b. Coordination information, including a list of changes or revisions needed to other parts of the work and to construction performed by owner and separate contractors that will be necessary to accommodate proposed substitution.

c. Detailed comparison of signification qualities of proposed substitution with those of the work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirement included. Indicate deviations, if any, from the work specified.

d. Product Data, including drawings and descriptions of product and fabrications and installation procedures.

e. Samples, where applicable or requested.

f. Certificates and qualification data, where applicable or requested.

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

h. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the work, including effect on overall contract time. If specified product or method of construction cannot be provided within contract time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

i. Cost information, including a proposal of change, if any, in contract sum.

j. Contractor's certification except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

k. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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

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

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

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

(1) Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to

Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

(2) Requested substitution does not require extensive revisions to the contract documents.

(3) Requested substitution is consistent with the contract documents and will produce indicated results.

(4) Substitution request is fully documented and properly submitted.

(5) Requested substitution will not adversely affect Contractor's construction schedule.

(6) Requested Substitution has received necessary approvals of authorities having jurisdiction.

(7) Requested Substitution is compatible and has been coordinated with other portions of the work.

(8) Requested Substitution provides specified warranty.

(9) If requested Substitution involves more than one contractor, requested substitution has been coordinated with other products, and is acceptable to all contractors involved.

C. Submittals: Each Subcontractor shall submit through the General Contractor, to the Architect at proper times, all Shop Drawings, Product Data, and setting diagrams which the Architect may deem necessary to illustrate the Work intended or show its relation to Work of other trades. Shop Drawings and Product Data shall contain manufacturer's name, material description, sizes and dimensions, and other pertinent information. All submittals, including resubmittals, shall have Product Data identifying the materials to be supplied by circling or denoting the intended materials on the Product Data sheets.

1. Prohibited Submittals: Contractors shall not duplicate Design/Working Drawings for use as Shop Drawings. Duplicated Drawings of this nature shall be rejected.

2. Required Information: Include in submittals sufficient drawings, plans, elevations, sections, performance data, dimensions, bolt locations, inserts, sound data, weights and schematics to clearly describe the equipment and to show compliance with the Specifications. Provide a cover or title sheet for each submittal containing the following:

a. Name of Contractor originating the submittal.

b. Name of Project for which the submittal is made.

c. An index of all items submitted.

d. Identification of each item of material and equipment.

e. Date of submittal.

f. Contractor's certification.

D. Deviations: Any and all deviations from the Specifications and/or Drawings must be brought to the Architect's attention by circling all items submitted for review.

E. Identification: Shop Drawing submittals and transmittal letters shall be identified with title and location of Project, names of the Architect, the Contractor, and the submission date.

F. Compliance Review: All Shop Drawings and Product Data submitted to the Architect shall be stamped by the General Contractor to indicate that the submittal has been reviewed for compliance with the Contract Documents, coordination between other Trade Work, and related details.

G. Reimbursement of Architect's Costs:

1. In the event substitutions are proposed to the Architect after the Contract has been awarded, the Architect will record all time used by the Architect and the Architect's consultants in evaluation of each proposed substitution.

2. Whether or not the Architect approves a proposed substitution, the Contractor shall promptly upon receipt of the Architect's billing, reimburse the Architect at the rate of two and three-quarter (2-3/4) times the direct cost of the Architect and the Architect's consultants for all time spent in evaluating the proposed substitution.

H. Architectural and Structural Shop Drawings: The General Contractor shall submit to the Architect, for review a PDF digital copy of each drawing.

1. If the Shop Drawings are returned "Revise & Resubmit", the effected Contractor shall correct the original Drawings and resubmit the Shop Drawings as originally required, i.e., PDF digital copy to the Architect for review, file, and distribution.

2. Submit PDF digital copies of Product Data such as catalog cuts and brochures.

I. Mechanical and Electrical Shop Drawings: Submit for review PDF digital copy of all equipment and products in a brochure type format.

J. Required Shop Drawings: Shop Drawings are required for, but are not necessarily limited to the items as required by the Drawings and/or Specifications within the Project Manual.

K. Review of Shop Drawings:

1. It shall be distinctly understood that the review of Shop Drawings shall be for General Scheme only. Review does not relieve the Contractor from the necessity of correcting, without charge, details on the Drawings and completed Work found deficient in strength or otherwise faulty.

2. The Architect assumes no responsibility for “figured dimensions” of Shop Drawings.

3. The review of Shop Drawings does not relieve or modify the responsibility for compliance with the Contract Documents or dimensions or errors contained in the submittal or quantity count. It is clearly understood that in the review process, noting of some discrepancies, but overlooking others, does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings, layout drawings, catalog data and brochures, the Contract Documents govern the Work, and are neither waived nor suspended in any way by the review of Shop Drawings, layout drawings, catalog data and brochures.

4. Upon completion of the Project the Owner shall be given one (1) set of reviewed Shop Drawings.

L. Authorization: Unless specifically otherwise required by the Architect and the Owner, no materials shall be ordered, delivered, fabricated, or erected until the proper written review by the Architect has been received by the General Contractor.

1.02 SAMPLES AND LETTERS OF INTENT

A. Summary Listing: General Contractor shall prepare a summary listing of the Samples and Letters of Intent submittal requirements for review by the Architect and the Owner’s Supervising Engineer.

B. Material Samples and Letters of Intent: Samples and Letters of Intent as listed and requested in the respective trade Specifications enumerate, but do not necessarily limit, the material Samples or Letters of Intent indicating materials, specifications, and/or installation procedures, which shall be submitted for approval PRIOR to purchase or installation of materials. All material Samples shall be reviewed by the Architect, and/or Owner PRIOR to erection or fabrication.

C. Samples: Submit to Architect for review, four (4) actual Samples of all materials to be used in the Work. All Samples shall have the same finish as that to be used in the completed Work. Manufacturer's color charts and/or color swatches shall not be acceptable as Samples. Samples shall be accompanied by a letter requesting approval and presenting all required data.

D. Materials: All materials furnished shall be fully equal to the reviewed Samples.

E. Selections: Where the choice of more than one make or style of article or material is specified, the final selection of the article or material shall be made by the Owner.

F. Quality, Fitness, and Workmanship: The quality or fitness of materials or workmanship shall be based on the requirements that all Work done or materials furnished shall be first class in every respect, and what is usual or customary on other projects shall in no way enter into any consideration or decision.

G. Differences in Price: Where any difference occurs in price of such articles or materials, such differences are to be given before the Contracts are signed. After the Contracts have been signed, the Owner reserves the right to choose whichever article or material the Owner desires, assuming, unless previously advised to the contrary, the price is not changed thereby. Where the Specifications require a specific item "equal or comparable products" or other words to that effect, the final selection will be by the Owner.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 45 23
TESTING AND INSPECTING SERVICES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included:

1. Owner will obtain the services of an Independent Testing Laboratory to perform testing services for concrete, steel and other materials as required, specified or directed. The Testing Laboratory shall evaluate and approve all soils testing performed by the Project Soils Engineer.

2. Requirements for testing are described in various sections of the Specifications. Where no testing requirements are described, but the Owner determines that testing is required, the Owner may require testing to be performed under currently recognized standards for testing.

B. Related Work:

1. Selection of Testing Laboratory: The Owner will select and approve a qualified, unbiased, and recognized independent commercial testing agency.

1.02 CODES AND STANDARDS

A. Testing, when required, shall be in accordance with all pertinent codes and regulations, and with selected ASTM International Standard Specifications.

1.03 TEST REPORTS AND RELATED INSTRUCTIONS

A. Promptly process and distribute all required copies of test reports and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay to progress of the Work.

1.04 PAYMENT FOR TESTING SERVICES

A. Initial Services: The General Contractor is to pay for all Owner Selected initial testing services.

B. Retesting: When the initial tests indicate non-compliance with Contract Documents, all subsequent retesting occasioned by the non-compliance shall be performed by the same agency, and the costs thereof will be paid by the General Contractor.

1.05 CODE COMPLIANCE TESTING

A. Responsibility of Inspection and Testing: Inspection and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities or a legally constituted authority, shall be the responsibility of, and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

1.06 TESTING LABORATORY DUTIES

A. Cooperation: Cooperate with Architect/Engineer and Contractor; provide qualified personnel after due notice.

B. Perform Specified Inspections, Sampling and Testing of Materials and Methods of Construction:

1. Take all specimens and samples.

2. Provide all sampling equipment and personnel.

3. Make all deliveries of specimens and samples to the Testing Laboratory.

4. Comply with specified standards.

5. Ascertain compliance of materials, and Work, with requirements of Contract Documents.

C. Irregularities and Deficiencies: Immediately notify Architect/Engineer, Owner's Supervising Engineer, and Contractor of observed irregularities or deficiencies of Work or products in the field or laboratory as a result of testing. All irregularities and deficiencies encountered shall not go unresolved. Testing reports submitted to Architect/Engineer shall be for file purposes only and shall include the resolution of these irregularities and/or deficiencies.

D. Reports of Tests and Inspections: Promptly submit written report of each test and inspection; one (1) copy each to Owner's Supervising Engineer, Owner, and Contractor, and three (3) copies to Architect/Engineer. Each report shall include:

1. Date issued.

2. Detailed listing.

3. Project title and number.

4. Testing Laboratory name, address and telephone number.

5. Name and signature of laboratory inspector.

6. Date and time of sampling or inspection.

7. Record of temperature and weather conditions.

8. Date of test.

9. Identification of product and Specification section.

10. Location of sample or test in the Project.

11. Name of person taking sample or making test.

12. Type of inspection or test.

13. Results of tests and compliance with Contract Documents.

14. Interpretation of test results, when requested by Architect/Engineer.

E. Additional Tests: Perform additional tests as required by Architect/Engineer, Owner's Supervising Engineer, or Owner.

F. Special Inspections: Submit “Statement of Special Inspections” and a certified written report of each special inspection, test or similar service; one (1) copy each to Owner's Supervising Engineer, Owner, and Contractor, and three (3) copies to Architect/Engineer. Submit additional copies of each report to governing authority, when the authority so directs.

1. Report Data: Written inspection or test reports for the Project shall include, but shall not necessarily be limited to applicable special inspections listed below:

   a. Inspection of Fabrication per Building Code Section 1704.2, and as required by Structural Drawings.

   b. Inspection of Steel Construction per Building Code Section 1704.3, and as required by Structural Drawings.

c. Inspection of Concrete Construction per Building Code Section 1704.4, and as required by Structural Drawings.

d. Inspection of Masonry Construction per Building Code Section 1704.5, and as required by Structural Drawings.

e. Inspection of Soils per Building Code Section 1704.7, and as required by Structural Drawings.

f. Inspection of Pier Foundations per Building Code Section 1704.9, and as required by Structural Drawings.

g. Inspection of Wall Panels and Veneers (seismic) per Building Code Section 1704.10, and as required by Structural Drawings.

h. Inspection of Exterior Insulation and Finish Systems (EIFS) per Building Code Section 1704.12.

1.07 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.

2. Approve or accept any portion of the Work.

3. Perform any duties of the Contractor.

1.08 CONTRACTOR'S RESPONSIBILITIES

A. General: Cooperate with laboratory personnel, provide access to Work, to material manufacturer’s operations.

B. Samples: Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Preliminary Design Mixes: Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the Testing Laboratory.

D. Test Reports: Furnish copies of Products test reports as required.

E. Furnish Incidental Labor and Facilities:

1. To provide access to Work to be tested.

2. To obtain and handle samples at the source of the product to be tested.

3. To facilitate inspections and tests.

4. For storage and curing of test samples.

F. Notification to Laboratory: Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.

G. Contractor's Convenience Testing: For testing performed exclusively for Contractor's convenience, employ and pay for the services of a separate, equally qualified Independent Testing Laboratory.

H. Payment for Testing Services: Pay for services of Owner selected Testing Laboratory to extent previously specified in Article 1.04 PAYMENT FOR TESTING SERVICES.

1.09 SCHEDULES FOR TESTING

A. Time Required for Testing: By advance discussion with the testing agency selected by the Owner, determine the time required for the testing agency to perform its tests and to issue each of its findings. Provide all required time within the construction schedule.

B. Changes in Construction Schedules: When changes of construction schedules are necessary during construction, coordinate all such changes of schedules with the testing agency as required.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, transportation, protection, and services necessary for, and incidental to, the proper execution and completion of all Temporary Facilities and Control Work, as indicated on the Drawings and as specified herein. Work includes, but is not necessarily limited to the following:

1. Temporary Utilities: Water service and distribution, Temporary electric power and light, temporary heat, Telephone service and sanitary facilities, including drinking water.

2. Support Facilities: Field Offices, Storage sheds, Temporary Enclosures, Construction Aids and Miscellaneous services and facilities.

3. Security and Protection Facilities: Temporary fire protection, Barricades, Warning signs and Lights.

1.02 USE CHARGES

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

B. Sewer Service: The General Contractor will pay sewer service use charges for sewer usage by all entitles for construction operations.

C. Water Service: The General Contractor will pay water service use charges for water usage by all entitles for construction operations.

D. Electric Power Service: The General Contractor will pay electric power service use charges for electricity usage by all entitles for construction operations.

1.03 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, Utility hookups, Staging areas, and Parking areas for construction personnel.

B. Erosion and Sedimentation Control Plan: Show compliance with requirements of EPA Construction General Permit of authorities having jurisdiction, whichever is more stringent. Coordinate with the Civil Engineer's drawings and specifications.

C. Moisture Protection Plan: Describe procedures and controls for protecting materials and construction form absorption and damage; including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed work, and replacing water damaged work.

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

D. Dust Control and HVAC Control Plan: Submit coordination drawing and narrative that indicated the dust-control and HVAC control measures proposed for use, proposed locations, and proposed time frame for their operations. Dust Control shall be per TCEQ (Texas Commission of Environmental Quality) and City Ordinance requirements. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Location of dust control partitions at each phase of the work.

2. HVAC system isolation schematic drawing.

3. Location of proposed air filtration system discharge.

4. Other dust control measures.

5. Waste management plan.

1.04 QUALITY ASSURANCE

A. General: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, Building Code, City Ordinance Requirements, Health and safety regulations and Utility Company Regulations.

B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Electrical Service: Comply with NECA, NEMA, and UL Standards and regulations and requirements of authority having jurisdiction for temporary electric service. Install service in compliance with NFPA 70 “National Electric Code.”

2. Accessible Temporary Egress: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ANSI A117.1.

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

1.05 PROJECT CONDITIONS

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

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

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

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

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

D. Lumber and Plywood: Comply with requirements in Division 6 Section “Rough Carpentry.”

E. Tarpaulins: Provide waterproof, fire resistant, UL Labeled tarpaulins with flame spread rating of 15 of less per ASTM E84. For temporary enclosures, provide translucent, nylon reinforced, laminated polyethylene or poly vinyl chloride, fire retardant tarpaulins.

F. Polyethylene Sheet: Reinforced, fire resistance sheet, 10 mils minimum thickness, with flame spread rating of 15 of less per ASTM E84.

G. Dust control Adhesive Surface Walk-Off Mats: Provide mats minimum 36 by 60 inches.

H. Insulation: Unfaced mineral fiber blanket, manufacturer from glass, slag wool, or rock wool; with maximum flame spread of 25 and smoke developed indexes of 50 per ASTM E84.

I. Water: Provide potable water approved by local health authorities.

2.02 TEMPORARY FACILITIES

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

B. A Job Site Trailer: Of sufficient size to accommodate needs of the Owner and construction personnel office activities and to accommodate project meetings. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for project site documents including file cabinets, plan table, plan racks, and bookcases.

2. Conference room of sufficient size to accommodate meeting of 10 individuals. Provide electrical power service and 120 V AC duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4 foot square tack and marker boards.

3. Drinking water and private toilet.

4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.

5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

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

1. Store combustible materials apart from building.

2.03 EQUIPMENT

A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide ¾ inch, heavy-duty, abrasion resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA polarized outlets to prevent insertion of 110 to 112 Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

E. Lamps and Light fixtures: Provide general service efficient lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.

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

1. Use of gasoline burning heaters, open flame heaters, or salamander type heating units is prohibited.

2. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.

3. Permanent HVAC Systems: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at the end of construction and clean HVAC system as required in Division 01 Section “Closeout Procedures.”

G. Temporary Offices: Provide prefabricated or mobile units or similar job built construction with lockable entrances, operable windows, and serviceable finishes. Provide heat heated and air conditioned unit on foundations adequate for normal loading.

H. Temporary Toilet Units: Provide self contained, single occupant toilet units of chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.

I. Fire Extinguishers: Provide hand carried, portable, UL rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand carried, portable, UL rated, Class ABC, dry chemical extinguishers or a combination of extinguishers of NFPA recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.

1. Locate facilities to limit site disturbance as specified in Division 01 Section “Summary.”

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

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

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

2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked in services.

3. Use Charges: Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders. The contractor can connect to existing water and electrical service and the owner will pay use charges for water and electricity. The contractor shall provide all other use charges including cost for temporary heat.

B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use. Obtain all required permits.

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

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

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

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

F. Electric Power Service: Provide power service and distribution system of sufficient size, number of phases, capacity, and power characteristics required for construction operation and testing of all installed equipment.

1. Install electric power service overhead, unless otherwise indicated.

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

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

H. Telephones Service: Provide temporary telephone service in Owner’s use facilities for use by all construction personnel. Install two telephone lines for each field office. One telephone to be dedicated for facsimile machine in each field office.

1. At each telephone, post a list of important telephone numbers, including but not limiting to, Police & Fire departments, Contractor’s home Office, Design Professional’s office, Testing Consult’s office, Owner’s office, principal subcontractors’ field & home offices and superintendent’s cellular telephone.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within the construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with requirements of NFPA 241

2. Maintain support facilities until near Substantial Competition inspection date is scheduled. Remove prior to substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

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

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.

2. Prepare sub grade and install sub base and base for temporary roads and paved areas specified in individual specification sections.

3. Delay installation of final course of permanent hot mix asphalt pavement until immediately before Substantial Completion. Repair hot mix asphalt base course pavement before installation of final course.

C. Traffic Controls: comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.

2. Maintain access for firefighting equipment and access to fire hydrants.

D. Parking: Provide temporary areas for construction personnel.

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

1. Dispose of rainwater in a lawful manner that will not result in flooding the project or adjoining properties nor endanger permanent work of temporary facilities.

2. Remove snow and ice as required to minimize accumulations.

F. Waste Disposal Facilities: Provide waste collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

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

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

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

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 sq. ft. or less with plywood or similar material.

3. Close openings through floor or roof decks and horizontal surfaces with load bearing, wood framed construction.

4. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use UL labeled, fire retardant treated material for framing and main sheathing.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

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

C. Storm water Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and sub grade construction to prevent flooding by runoff of storm water from heavy rains.

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

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

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to the Owner.

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

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

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

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

I. Temporary Fire Protection: Install and maintain temporary fire protection facilities of the type needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 “Standard for Portable Fire Extinguishers” and NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations.”

1. Locate fire extinguishers where convenient and effective for their intended purpose.

2. Store combustible materials in containers in fire safe locations.

3. Maintain unobstructed access to fire extinguishers, fire hydrants, and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.

4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.

3.05 MOSTURE AND MOLD CONTROL

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

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.

2. Protect stored and installed material from flowing or standing water.

3. Keep porous and organic materials from coming into prolonged contact with concrete.

4. Remove standing water from decks.

5. Keep deck openings covered or dammed.

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

1. Do not load or install drywall or other porous materials or components, or items with High organic content, into partially enclosed building.

2. Keep interior spaces reasonably clean and protected from water damage.

3. Periodically collect and remove waste containing cellulose or other organic matter.

4. Discard or replace water-damaged material.

5. Do not install material that is wet.

6. Discard, replace or clean stored or installed material that begins to grow mold.

7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

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

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.

2. Use permanent HVAC system to control humidity.

3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.

b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to the Design Professional.

c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.06 OPERATION, TERMINATION, AND REMOVAL

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

B. Maintenance: Maintain facilities in good operating conditional until removal. Protect from damage by freezing temperatures and similar elements.

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

2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

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

D. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized

use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Material and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.

2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, clean and renovate permanent facilities used during the construction period. Comply with final cleaning requirements specified in Section 01 70 00 – Project Closeout.

END OF SECTION

SECTION 01 70 00
PROJECT CLOSEOUT

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Closeout Work shall include preparation for final acceptance, occupancy, and similar actions evidencing completion of the Work. The time of closeout is recognized to be directly related to “Substantial Completion”, and therefore may be either a single time period for the entire Work or a series of time periods for individual parts of the Work which have been certified as substantially complete at different dates. That time variation (if any) shall be applicable to other provisions of this section, regardless of whether resulting from “phased completion” originally specified by the Contract Documents or subsequently agreed upon.

1.02 PREREQUISITES FOR SUBSTANTIAL COMPLETION

A. General: Prior to Certification of Substantial Completion, submit one (1) set of the following documents to the Owner, and list known exceptions:

1. Submit statement showing final accounting of changes to the Contract Sum.

2. Advise of pending insurance change-over requirements.

3. Submit guarantees, warranties, workmanship bonds, maintenance agreements, final certifications and similar documents. Submit list of contacts, including company name, personal contact, address, telephone number and e-mail for building equipment and components which may require periodic service, including roofing, mechanical and electrical equipment.

4. Obtain and submit occupancy permits, operating certificates, final inspection/test certificates, and similar releases enabling full and unrestricted use of the Work and access to services and utilities.

5. Submit record (As-Built) Drawings, operation and maintenance manuals, Subcontractor listing with address, telephone number and e-mail, final Project photographs, damage or settlement survey, property survey, and similar final record information.

B. Tools, Spare Parts, and Extra Stock Materials: Deliver tools, spare parts, extra stocks of materials, and similar physical items.

C. Locks and Keys: Make final change-over of locks and transmit keys to Owner or Tenant, and advise to change-over in security provision.

D. Testing of Systems: Complete start-up testing of systems, and instruction of operating/maintenance personnel.

E. Temporary Facilities and Services: Discontinue (or change over) and remove from the Project site temporary facilities and services, along with construction tools and facilities, mock-ups, and similar elements.

F. Final Cleaning: Complete the final cleaning.

G. Exposed Finish Surfaces: Touch-up, repair, and restore marred exposed finishes.

H. Meter Readings for Temporary Utilities: Submit final meter readings for temporary utilities, measured record of stored fuel, and similar data as of the time of substantial completion or when Owner took possession of, and responsibility for, corresponding elements of the Work.

1.03 PREREQUISITES TO FUNCTIONAL COMPLETION

A. All TAB (Test, Adjust and Balance) work and the commissioning of Section 01 91 13 must be complete prior to Functional Completion, unless approved in writing by the Owner's Project Manager. Exceptions to this are the planned control system training performed after occupancy and any required seasonal or approved deferred testing. This includes for all systems, but is not limited to:

1. Completed and signed start-up and prefunctional checklist documentation.

2. Requested trend log data.

3. Submission of final approved TAB report.

4. Completion of all functional testing.

5. Required training of Owner personnel completed and approved.

6. Submission of the approved O & M manuals.

7. All identified deficiencies have been corrected or are approved by the Owner to be excepted from this milestone.

1.04 RECORD DOCUMENT SUBMITTALS

A. General: Specific requirements for record documents are indicated in individual sections of the Specifications. The general requirements are indicated in the General Conditions, with

additional provisions indicated in Section 01 01 00 - General Scope of Work, and Specification Divisions as required for Mechanical and Electrical Work, respectively. DO NOT USE record documents for construction purposes; protect from deterioration and loss in a secure fire-resistive location.

B. Record Drawings:

1. Contractors shall keep an accurate record of “As-Built” conditions as the Work progresses. Mark-up Drawings to indicate variance, at the time the variance occurs.

2. Maintain a white print set (blue line or black line) of complete Construction Documents and Shop Drawings, in clean undamaged condition, for the purpose of checking and recording all installations which vary substantially from the Work as originally shown. The records shall include changes in sizes, locations, and dimensions, as well as any resulting from Bulletins, Change Orders, or Field Orders.

3. Mark whichever Drawing is most capable of showing the “As-Built” condition fully and accurately; however, where Shop Drawings are used for mark-up, record a cross-reference at the corresponding location on the Contract Drawings.

4. Mark with red erasable pencil and, where feasible, use other colors to distinguish between variations of separate categories of Work.

5. Mechanical and Electrical Contractors shall give particular attention to concealed Work, and record all concealed mechanical and electrical services by color code. Record shall include exact locations of pipe, conduit, wire and cable, valves and all underground or otherwise concealed Mechanical and Electrical Work, properly dimensioned from adjacent building walls and with invert elevations noted. Record shall include all principal dimensions of concealed Work and any special notations such as valve numbers.

6. Obtain a complete set of reproducibles using the Architect’s original tracings and any Shop Drawings used for Record Drawings. Transfer all corrections, changes, and revisions from the job record set to the reproducibles and add to the legend “Record Drawings” and the date of printing to each reproducible. Within thirty (30) days of completion of job, print one (1) complete set of blacklines or blueprints. The reproducibles and blacklines or blueprints shall become the property of the Owner.

7. Organize Record Drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

C. Maintenance Manuals:

1. Organize maintenance and operating manual information into individual binders properly identified, indexed, and thumb tabbed; such as Building Maintenance, Tile Maintenance, Roof Maintenance. Include names, addresses, telephone numbers, and e-mails of equipment vendors and Subcontractors. Submit one (1) copy to the Owner within thirty (30) days of Substantial Completion to be retained by the Owner for his records and use.

2. Include information such as emergency instructions, spare parts listing, warranties and guarantees with name, telephone number and e-mail of contact person, wiring diagrams, recommended “turn-around” cycles, inspection procedures, Shop Drawings, Product Data, names and addresses of each supplier, names and addresses of contractor and sub-contractors with contact person telephone number, e-mails, and similar applicable information.

3. Bind each manual of each set in a heavy-duty, 3-ring, vinyl-covered binder (not less than 2" capacity), and include pocket folders for folded sheet information. Mark identification on the front and spine of each binder.

1.05 CLOSEOUT PROCEDURES

A. General Operating/Maintenance Instructions: Arrange for each installer of Work requiring continuing maintenance or operation, to meet with personnel at the Project site to provide instructions needed for proper operation and maintenance of all equipment or components.

1. Include instructions by manufacturer’s representatives where installers are not expert in the required procedures.

2. Review maintenance manuals, record documentation, tools, spare parts and materials, lubricants, fuels, identification system, control sequences, hazards, cleaning and similar procedures and facilities.

3. For operational equipment, demonstrate start-up, shut-down, emergency operations, noise and vibration adjustments, safety, economy/efficiency adjustments, and similar operations.

4. Review maintenance and operations in relation with applicable guarantees, warranties, agreements to maintain, bonds, and similar continuing commitments.

1.06 FINAL CLEANING

A. General: Provide cleaning for specific units of Work as specified within the Specifications Sections listed under the Table of Contents in the Project Manual. Provide final cleaning of the Work, at the time indicated, consisting of cleaning each surface or unit of Work to the

normal “clean” condition expected for a first-class building cleaning and maintenance program. Comply with manufacturers' instructions for cleaning operations.

B. Cleaning Requirements: The following are examples, but not by way of limitation, of the cleaning levels required, including removing all marks, stains, soil, and fingerprints from all completed Work.

1. Remove manufacturer’s or contractor’s labels which are not required as permanent. Remove protective coverings and tags, except for those required to demonstrate compliance with building codes, fire-ratings and testing. Also remove all residue and glue remaining on the surface.

2. Clean transparent and reflective glass materials, including window/door glass and mirrors with ammonia-type, non-streaking glass cleaner, to a polished condition, removing substances which are noticeable as vision-obscuring materials. Replace broken or damaged glass and mirrors.

3. Clean exposed exterior and interior hard-surface finishes, including metals, masonry, stone, concrete, painted surfaces, plastics, tile, wood, and similar surfaces, to a dirt-free condition, free of dust, stains, films and similar noticeable distracting substances. Except as otherwise indicated; avoid the disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition.

4. Wipe surfaces of mechanical and electrical equipment clean, and remove excess lubrication and other substances. Change filters within HVAC equipment.

5. Remove debris and surface dust from limited-access spaces including roofs, plenums, trenches, manholes, attics and similar spaces.

6. Clean concrete floors in non-occupied spaces broom clean.

7. Vacuum clean soft material surfaces, such as carpeted and similar surfaces.

8. Clean, sanitize and polish all fixtures, and washable surfaces in the Toilet Rooms. Clean plumbing fixtures to a sanitary condition, free of stains including those resulting from water exposure.

9. Damp wipes and cleans all fixtures, including light fixtures and lamps so as to function with full efficiency. Replace burned-out or broken lamps.

10. Wash, clean and polish all porcelain and/or ceramic tile surfaces.

11. Remove and dispose of all trash, scraps, packing, and all other construction debris.

12. Clean Project site (yard and grounds), including landscape, development areas, of litter and foreign substances. Sweep paved areas to a broom-clean condition; remove stains, petro-chemical spills and other foreign deposits. Rake grounds which are neither planted nor paved, to a smooth, even-textured surface.

C. Damages: Any damage caused by Contractors with cleaning equipment shall be repaired or replaced by the Contractor responsible for the damage.

D. Time of Final Cleaning: Following Certification of “Substantial Completion”.

1.07 PEST CONTROL

A. Engage an experienced exterminator to make a final inspection of the Project, and to eliminate the Project of rodents, insects, and other pests. Comply with governing regulations and applicable health and safety standards.

1.08 REMOVAL OF PROTECTION

A. Except as otherwise indicated or requested, remove temporary protection devices and facilities which were installed during the course of the Work to protect previously completed Work during the remainder of the construction period.

1.09 COMPLIANCES

A. Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at the site, or bury debris or excess materials on the Owner’s property, or discharge volatile or other harmful or dangerous materials into drainage systems; remove waste materials from the site and dispose of in a lawful manner. At no time during or at completion of construction, place any excess material, into Owner’s compactor or container.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 73 00
EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Construction layout.

2. Field engineering and surveying.

3. Installation of the Work.

4. Cutting and patching.

5. Coordination of Owner-installed products.

6. Progress cleaning.

7. Starting and adjusting.

8. Protection of installed construction.

9. Correction of the Work.

B. Related Requirements:

1. Section 01 33 23 "Shop Drawings and Samples". Revise first subparagraph below to suit Project.

2. Section 01 70 00 "Project Closeout" Procedures for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

3. Section 078456 and 079000 for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor professional engineer.

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

C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.

2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.

3. Products: List products to be used for patching and firms or entities that will perform patching work.

4. Dates: Indicate when cutting and patching will be performed.

5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

D. Final Property Survey: Submit 6 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

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

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

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following; but not limited to:

a. Primary operational systems and equipment.

b. Fire separation assemblies.

c. Air or smoke barriers.

d. Fire-suppression systems.

e. Mechanical systems piping and ducts.

f. Control systems.

g. Communication systems.

h. Fire-detection and -alarm systems.

i. Conveying systems.

j. Electrical wiring systems.

k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or those results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

   a. Water, moisture, or vapor barriers.

   b. Membranes and flashings.

   c. Exterior curtain-wall construction.

   d. Sprayed fire-resistive material.

   e. Equipment supports.

   f. Piping, ductwork, vessels, and equipment.

   g. Noise- and vibration-control elements and systems.

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

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

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

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.

2. List of detrimental conditions, including substrates.

3. List of unacceptable installation tolerances.

4. Recommended corrections.

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

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

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

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

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.

B. General: Engage a land surveyor professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.

2. Establish limits on use of Project site.

3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

4. Inform installers of lines and levels to which they must comply.

5. Check the location, level and plumb, of every major element as the Work progresses.

6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.

7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

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

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

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

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect and Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate

permanent benchmarks or control points to Architect and Construction Manager before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

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

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.

3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

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

1. Make vertical work plumb and make horizontal work level.

2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

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

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

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

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

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

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

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

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.

2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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

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

3.6 CUTTING AND PATCHING

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

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

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

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

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

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

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

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

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required,

and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

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

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

   b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

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

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

2. Pre-installation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

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

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

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.

3.9 STARTING AND ADJUSTING

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

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

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

3.10 PROTECTION OF INSTALLED CONSTRUCTION

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

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

END OF SECTION

SECTION 01 81 19
INDOOR AIR QUALITY REQUIREMENTS

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, transportation, protection, and services necessary for, and incidental to, the proper execution and completion of all Indoor Air Quality Requirements, as specified herein. Work includes, but is not necessarily limited to the following:

1. Construction procedures to promote adequate indoor air quality after construction.

2. Building flush-out after construction and before occupancy.

3. Testing indoor air quality after completion of construction.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Testing and Inspecting Services - Section 01 45 23.

2. Temporary Facilities and Controls - Section 01 50 00.

3. HVAC Filters - Section 24 40 00.

4. Testing, adjusting, and balancing for HVAC - Section 23 05 93.

1.02 PROJECT GOALS

A. Maintain a healthy environment for the present and future occupants of the building. Therefore, the Contractor shall conduct the work in such a way as to avoid creating indoor air quality problems.
Required procedures:

1. Limiting use of products that may contribute to poor indoor air quality.

2. Maintaining work procedures which contain and alleviate dusts and odors and air-borne contaminants.

3. Protection of materials from moisture.

B. The Contractor's attention is directed to provisions throughout the Contract Documents intended to maintain indoor air quality during construction and after completion of the Project. These provisions will be strictly enforced. The Contractor shall notify and require each subcontractor, sub-subcontractor and materials vendors to comply with such provisions.

1.03 DEFINITIONS

A. Definitions Pertaining to Sustainable Development: As defined in ASTM E2114.

B. Adequate Ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.

C. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabric, fibrous insulation, and other similar products.

D. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

E. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Throughout this specification, hazardous material includes hazardous chemicals.

1. Hazardous materials include: pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).

F. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air, including those that impact thermal comfort such as air temperature, relative humidity and air speed.

G. Interior final finishes: Materials and products that will be exposed at interior occupied spaces; including flooring, wall covering, finish carpentry, and ceilings.

H. Packaged dry products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.

I. Particulates: Dust, dirt, and other airborne solid matter.

J. Wet products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.

K. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.04 REFERENCE STANDARDS

A. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE): ASHRAE Standard 62 -2007, Ventilation for acceptable Indoor Air Quality.

B. American National Standards Institute (ANSI)/ASHRAE Standard 52.2 -1999: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

C. Sheet Metal and Air Conditioning National Association (SMACNA): “IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition 2007” and Duct Cleanliness for New Construction Guideline.” D. U.S. Environmental Protection Agency Compendium of Method for Determination of Air Pollutants in Indoor Air.

1.05 PERFORMANCE REQUIREMENTS

A. VOC Emissions: Products have been selected for this Project with respect to their emissions of Volatile Organic Compounds, in order to limit concentrations of VOC’s in occupied spaces.

1. Substitution for any specified VOC-containing product specified will be considered with the condition that acceptable VOC-emission data are available for the proposed product, or the Contractor arranges to have that product tested for VOC emissions by an independent laboratory.

B. Airborne Dust: Dust Partitions, site dust control measures and other construction practices shall be maintained to prevent airborne dust from leaving the site or accumulating in the building interior.

C. Moisture: Weather protection, scheduling of the work, restoration drying techniques using desiccants drying, dehumidification and other construction practices shall be used to maintain the schedule and to prevent construction materials from reaching moisture levels that will support the growth of mold, bacteria and other biological contaminants.

1. Maximum Equivalent Moisture Content (EMC) of substrates installed wet or wetting during the construction process such as concrete, and concrete block shall be measured before application of mold-sensitive finishes. Installation of the following products shall not proceed until the relative humidity in the substrate does not exceed 70 percent relative Humidity (RH) as measured using ASTM F 2170, or in accordance with the manufactures ‘s written limitations, whichever is lower:

    a. Non-preservative-treated wood products.

    b. Gypsum Wallboard.

    c. Carpet.

    d. Acoustical Ceiling Tile.

    e. Fabric-covered acoustical panels and tack boards.

    f. Fixed upholstered seating.

2. Wood-based finish products such as flooring, architectural woodwork, casework, etc. shall additionally follow the environmental temperature and RH criteria limits established within the respective sections.

1.06 SUBMITTALS

A. General: Submit Shop Drawings, Product Data, and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Temporary HVAC Filters: Provide product data for during construction, at flush-out and installed at Substantial Completion, Highlighting MERV and other performance data.

C. Indoor Air Quality (IAQ) Management Plan: Not less than 10 days before the Pre-construction meeting, prepare and submit an IAQ Management Plan; use SMACNA IAQ Guidelines for Occupied Buildings Under Construction as a guide including, but not limited to, the following:

1. Indentify potential sources of odor and dust.

2. Identify construction activities likely to produce odor and dust.

3. Identify porous materials and absorptive materials.

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 scheduled for replacement of filters.

7. Describe cleaning and dust control procedures.

8. Describe storage and moisture protection control procedure.

9. Describe the building flush-out procedures including the dates when flush-out will begin and completed.

10. Describe coordination with commissioning procedures.

11. Describe the air contaminant test procedures including the following:

    a. Identify the Testing Agency qualifications.

    b. Identify the locations and scheduling of the air sampling.

    c. Describe Test procedures in detail.

    d. Indentify the Test instruments and apparatus.

    e. Describe the sampling method.

E. Interior Finishes Installation Schedule: Indentify each interior finish that either generates odors, moisture, or vapors or is susceptible to absorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

F. Construction Documentation: Size photographs at three different occasions during construction along with 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 material.

G. Duct and Terminal Unit Inspection Report.

H. Air Contaminant Test Reports: Provide the follow information in the Air Contaminant Test Report, but is not limited to, the following:

1. Location where each sample was taken and time.

2. Test values for each air sample; average the values of each set of 3.

3. HVAC operating conditions.

4. Certification of test equipment calibration.

5. Other conditions or discrepancies that might have influenced the results.

I. Moisture Testing: Evidence of testing of each substrate to receive mold-sensitive finishes in accordance with ASTM F 2170.

1.07 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years experience in performing the types of testing specified.

B. Maintain at the contraction site a complete and up-to-date binder of MSDS for all products on-site containing VOC's. Upon the request of the Owner, make the binder available for review.

PART 2 - PRODUCT

2.01 MATERIALS

A. Through the Work, use products, materials which contribute the minimum practicable dust, odors and contaminants to indoor environment.

B. Products containing Volatile Organic Compounds (VOC's):

1. Comply with the following criteria for VOC Limits for the following field-applied products.

2. No urea formaldehyde containing products will be permitted for use in this project.

C. Indoor Chemical and Pollutant Source Control:

1. Provide temporary walk-off mats to reduce entry of dust, moisture and other contaminants into the building during construction.

2. Refer to Section 12 48 13 - Entrance Floor Mats and Frames, for permanent floor grilles to be installed at building entrances. These floor grilles shall be protected from dust, moisture and other contaminants until Substantial Completion.

D. Mechanical Systems and Controls: Refer to specification sections in Divisions 21, 22, 23 and 26 for mechanical and electrical provisions for maintaining Indoor Air Quality.

PART 3 - EXECUTION

3.01 GENERAL PROCEDURES FOR PROTECTING INDOOR AIR QUALITY

A. General: Provide physical barriers, ventilation and other controls as specified to reduce potential for odors, dust, and fumes from affecting present and future occupants of the building, and to meet performance criteria specified herein.

B. Material Transport and Storage:

1. Store construction materials, including ductwork, in clean, dry areas protected from moisture and dust. Refer to individual specification sections for additional on-site storage requirements for individual materials and equipment.

2. No Storage of construction material or debris will be permitted within mechanical rooms.

3. Adsorptive materials shall be protected throughout storage at the site in their original wrapping material.

4. Keep waste materials that can release dust or odors covered and sealed when on site, and dispose of them promptly.

C. Installation Sequence: Schedule material installation and construction activities so as to avoid adsorption of VOC's and dust into adsorptive materials.

1. Provide protective cover for adsorptive materials that will be subjected to VOC off-gassing and dust.

a. Wrap adsorptive materials in polyethylene or other impermeable material and seal edges with tape.

b. Refer to SMACNA Guidelines for minimum requirements.

c. Protective cover is required for uninstalled materials stored in the construction area, as well as for installed materials.

2. Containers of VOC containing fluids shall be kept tightly sealed. When not in use, such containers shall be stored in a location remote from adsorptive materials or occupied areas.

3. Apply wet materials such as paints, coatings and products installed with adhesives, allowing them time to off gas before applying adsorptive or "sink" type products such as.

a. Acoustical ceiling tiles.

b. Carpet.

c. Fabric materials, upholstered products or fabric-wrapped panels for use as tack boards or acoustical purposes.

4. Permit carpeting to off gas for 48 hours at the plant prior to wrapping in plastic wrappings. Otherwise, before installation, open up carpet rolls and spread carpet out in an offsite location and ventilate in an area protected from weather, sources of moisture or other VOC's.

D. Regular Cleaning during Construction: The intent of these documents is to prevent accumulation of contaminant containing dirt and dust within the building during construction.

1. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces. Clean interior spaces prior to the start of finish painting and continue cleaning on as needed basis until painting is finished.

2. Use cleaning methods that minimize airborne dust. Recommended methods include:

a. Immediate removal of spills, excess applications of cleaning products and accumulated water.
b. Increased frequency of cleaning during construction, to maintain surfaces free of dust accumulation.
c. Use of wetting agents and sweeping compounds, and of efficient dust collection equipment such as damp mops and HEPA filtered vacuum cleaners.
d. Refer to SMACNA Guidelines for additional cleaning recommendations.

E. Protection of HVAC:

1. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

2. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

3. HVAC equipment and ductwork man NOT be used for ventilation during construction:

a. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.

b. Exhaust directly to outside.

c. Seal HVAC air inlets and outlets immediately after duct installation.

4. HVAC equipment and supply air ductwork may be used for ventilation during construction:

a. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.

b. Ensure that air filters are correctly installed prior to staring use; replace filters when they lose efficiency.

c. Do not use return air ductwork for ventilation.

d. Do not use return air ductwork for ventilation unless absolutely necessary.

e. Seal return air inlets or otherwise positively isolate return air system to prevent recirculation of air; provide alternate return air pathways.

f. Where return air ducts must be used for ventilation, install auxiliary filters at return inlets, sealed to ducts; use filters with at least the equivalent efficiency as those required at supply air side; inspect and replace filters when they lose efficiency.

5. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.

a. Inspect duct intakes, return air grilles, and terminal units for dust.

b. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduits.

c. Clean tops of doors and frames.

d. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduits, equipment, and supports.

e. Clean return plenums of air handling units.

f. Remove intake filters last, after cleaning is complete.

6. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

3.02 MIXING OF MULTI-COMPONENT PRODUCTS

A. General: Fluid-applied products furnished in two or more components shall be mixed thoroughly, in precise proportions so that an excess of one component will not remain uncured. The requirements of this section apply to all fluid-applied multi-component products, including but not limited to the following:

1. Multi-component adhesives.

2. Multi-component waterproofing and sealant products.

3. Multi-component paints and coatings

4. Multi-component fluid-applied floorings

B. Requirements:

1. All multi-component mixtures shall be brought to the Project Site in factory-sealed and premeasured containers with precise quantities required for proportional mixing. No bulk materials will be permitted on-site if not packaged in this manner.

2. Mix components in strict accordance with manufacturer's written instructions regarding quantities, mixing method and other conditions.

3. Each container of each component shall be completely mixed with the entire contents of a corresponding container of the second component.

a. No field mixing of partial quantities will be permitted.

b. Properly dispose of mixed components remaining unused at the end of a workday.

3.03 CONTROL OF COMBUSTION PRODUCTS

A. General: Minimize the use of fuel-burning equipment inside and near the building. Where fuel burning engines are necessary, cycle off equipment when not in use.

B. Vehicle Exhaust: No vehicles shall be left idling near temporary or permanent air intakes. Motorized vehicles used within the building shall be electrically powered.

C. Power Equipment: No internal combustion engines shall be operated within the building. Location of engines outside the building shall be remote from permanent air intakes and operable windows of occupied spaces.

D. Exhaust of Temporary Heating Equipment:

1. No temporary heating equipment that burns kerosene or other liquid fuel will be permitted within the building.

2. Temporary equipment that produces heat by combustion of fuel shall be installed with provisions to ventilate combustion gases to the exterior of the building.

E. Welding: Welding operations shall be properly ventilated.

F. Smoking: No smoking will be permitted within the construction site or adjacent areas at any time.

3.04 DUST CONTROL

A. General: The following provisions do not supersede specific requirements for methods of construction or applicable general conditions set forth elsewhere in the Contract with regard to performance obligations of the Contractor.

1. Maintain the construction site, stockpiles, access, detour, and haul roads, staging and parking area used for the Work, free of dust that would cause a hazard or a nuisance to those at the site or adjacent sites. Refer to Section 31 00 00 - EARTHWORK, for additional provisions for control of dust on the site.

2. Provide positive methods and apply dust control materials to minimize raising dust from construction operations, and use damp cloths and wetting agents or sweeping compounds to prevent air-borne dust from dispersing into the atmosphere.

3. Cutting of concrete and masonry products shall be performed using wet saw methods.

4. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

5. Clean interior spaces prior to the start of finish painting and continue cleaning on an as needed basis until painting is finished.

6. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces, including paint, coatings, sealants, caulking, adhesives.

B. Dust Partitions and Coverings:

1. Furnish, erect, and maintain for the duration of the work period, temporary fire-resistant dustproof coverings and solid partitions as required to prevent the spread of dust beyond the immediate area where work is being performed.

2. Temporary partitions for dust control shall extend from floor to bottom of structure above, to provide an air-tight barrier. Provide air-tight coverings for openings required for access through partitions.

3. Cover equipment installed within construction area using canvas, polyethylene and tape, or other materials as recommended by manufacturer of equipment for protection from airborne dust and vapors.

4. Refer to Section 01 50 00 – Temporary Facilities and Controls, for additional requirements for temporary partitions and related protective measures.

C. Prevent dust and odors from entering the new HVAC system. Confirm that the HVAC Subcontractor has sealed all diffusers, return side ductwork and equipment within the Work Area so as to prevent dust from entering. For further requirements, refer to SMACNA Guidelines and DIVISION 23 – Heating, Ventilating and Air Conditioning.

D. Prevent exterior dust and odors from entering interior space after building is enclosed. Whenever possible, seal window units with plastic as recommended in SMACNA Guidelines.

3.05 WATER DAMAGE

A. General: The General Contractor shall be responsible for protecting the Work from moisture, in order to prevent growth of harmful fungus, mold and other biological activity.

B. Protection of Existing and New Building Construction:

1. Refer to Section 01 50 00 - Temporary Facilities and Controls, for materials and installation of weatherproof enclosures.

2. Remove and replace construction which becomes wet, or which shows evidence of biological growth due to the presence of moisture.

C. Protection of Stored Construction Materials:

1. Take precautions to prevent porous materials such as gypsum board, insulation, ceiling tile, wood and similar products from becoming wet.

2. Refer to Section 01 50 00 - Temporary Facilities and Controls, for materials and installation of weatherproof enclosures.

3. Store materials above ground surfaces and provide spacers between ground and protective covering to allow for ventilation.

4. Discard construction material which becomes wet, or which shows evidence of biological growth due to the presence of moisture.

D. Procedures for drying out wet construction: In the case that an unanticipated event permits the entry of water into new or existing construction, the Contractor shall perform procedures to dry out construction within 24 hours, to a degree that will not support biological growth using restoration drying techniques.

1. Refer to guidelines published by the United States Environmental Protection Agency.

2. Construction that is not adequately dried out, or which shows evidence of biological growth, shall be removed immediately from the construction area and disposed of legally.

3. Wetting by contaminated water and subsequent cleaning and decontamination shall be supervised by a qualified company.

3.06 CLEAN UP

A. Prior to turning over work area to Owner, conduct final cleaning to remove dust to the minimum practicable level.

B. Clean ductwork, registers and grilles within the Work Area, and HVAC equipment servicing the Work Area using professional duct cleaning company.

C. After completion of duct cleaning, vacuum vertical and horizontal surfaces, ledges, trim, tops of light fixtures and other equipment, and other locations where dust has settled. Utilize HEPA filtered vacuum to capture fine dust.

D. Vacuum carpet tiles and fabric-covered surfaces with a high-efficiency particulate arrestor (HEPA) vacuum prior to Substantial Completion.

E. Do not use solvent-based cleaners in final cleaning of Work Area, unless cleaning occurs at least 14 days prior to Owner’s scheduled Active Use of the area.

F. Coils, air filters and fans in HVAC system shall be cleaned prior to final testing and balancing. Refer to Division 23 - HVAC, for requirements.

3.07 BUILDING FLUSH-OUT

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform building flush-out before occupancy.

C. Do not start flush-out until:

1. All construction is complete.

2. HVAC systems have been tested, adjusted, and balanced for proper operation.

3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.

4. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.

5. New HVAC filtration media have been installed.

D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot of floor area has been supplied.

1. Obtain concurrence that construction is complete enough before beginning flush-out.

2. Maintain interior temperature of at least 60 degrees F and interior relative humidity no higher than 60 percent.

3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.

4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 3,500 cubic feet per square foot of floor area prior to occupancy, and:

a. Begin ventilation at least three hours prior to daily occupancy.

b. Continue ventilation during all occupied periods until total air volume of 14,000 cubic feet per square foot of floor area has been achieved.

c. Provide minimum outside air volume of 0.30 cfm per square foot or design minimum outside air rate, whichever is greater.

E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

3.08 AIR CONTAMINANT TESTING

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform air contaminant testing before starting construction, as base line for evaluation of postconstruction testing.

C. Perform air contaminant testing before occupancy.

D. Do not start air contaminant testing until:

1. All construction is complete, including interior finishes.

2. HVAC systems have been tested, adjusted, and balanced for proper operation.

3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.

4. New HVAC filtration media have been installed.

E. Indoor Air Samples: Collect from spaces representative of occupied areas:

1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.

2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet take samples from areas having the least ventilation and those having the greatest presumed source strength.

3. Collect samples from height from 36 inches to 72 inches above floor.

4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.

5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.

6. When retesting the same building areas, take samples from at least the same locations as in first test.

F. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.

G. Analyze air samples and submit report.

H. Air Contaminant Concentration Determination and Limits:

1. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.

2. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.

3. Formaldehyde: Not more than 27 parts per billion.

4. Total Volatile Organic Compounds (TVOC): Not more than 500 micrograms per cubic meter.

5. 4-Phenylcyclohexene (4-PCH): Not more than 6.5 micrograms per cubic meter.

6. Particulates (PM10): Not more than 50 micrograms per cubic meter.

7. Regulated Pollutants: Measure in relation to outside air; not more than contained in outside air.

I. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Owner, or conduct full building flush-out specified above.

END OF SECTION

SECTION 02 28 20
TERMITE CONTROL

PART I - GENERAL

1.01 DESCRIPTION

A. Provide soil treatment for termite control, as herein specified.

1.02 QUALITY ASSURANCE

A. In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for the work, including preparation of substrate and application.

B. Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of soil treatment solution.

C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

B. To insure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with other handling and application instructions of the soil toxicant manufacturer.

1.04 SUBMITTALS

A. Comply with applicable provisions of Section 01 33 23.

B. Guarantee: Furnish 2 copies of written guarantee certifying that the applied soil poisoning treatment will prevent the infestation of subterranean termites and, that if subterranean termite activity is discovered during the guarantee period, the Contractor will retreat the soil and also repair or replace damage caused by termite infestation. Provide guarantee for a period of 5 years from date of treatment, signed by the Applicator and the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Soil Treatment Solution

1. Use an emulsible concentrate insecticide for dilution with water, specially formulated to prevent infestation by termites. Fuel oil will not be permitted as a

diluent. Provide a working solution of one of the following chemical elements and concentrations:

a. Dursban TC, 1.0% in water emulsion

b. Aldrin, 0.5% in water emulsion

c. Termide, 0.75% in water emulsion

d. Heptachlor, 0.5% in water emulsion

2. Other solutions may be used as recommended by Applicator and if acceptable to local governing authorities. Use only soil treatment solutions which are not injurious to planting.

PART 3 - EXECUTION

3.01 INSPECTION

A. Applicator must examine the areas and conditions under which soil treatment for termite control is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Applicator.

3.02 APPLICATION

A. Surface Preparation: Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicant may be applied before placement of compacted fill under slabs, if recommended by toxicant manufacturer.

B. Application Rates: Apply soil treatment solution as follows:

1. Under slab-on-grade structures, treat the soil before concrete slabs are poured using either power sprayer or tank-type garden sprayer.

a. Apply 4 gallons (15.1 liters) of chemical solution per 10 lin. ft. (3.0 m) to the soil critical areas under the slab, such as along the inside of foundation walls, along both sides of interior partition walls, and around plumbing.

b. Apply one gallon (3.78 liters) of chemical solution per 10 sq. ft. (0.9 sq. m) as an overall treatment under the slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallons (5.67 liters) is washed gravel or other coarse absorbent material.

c. Apply 4 gallons (15.1 liters) of chemical solution per 10 lin. ft. (3.0 m) of trench, for each foot (0.3 m) O.C. and apply chemical solution. Mix the chemical solution with the soil as it is being replaced in the trench.

C. Allow not less than 12 hours for drying after application, before beginning concrete placement or other construction activities.

D. Post signs in the areas of application warning workers that soil poisoning has been applied. Remove signs when areas are covered by other construction.

E. Re-apply soil treatment solution to areas disturbed by subsequent excavation or other construction activities following application.

END OF DOCUMENT

SECTION 02 41 19
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 013591 "Historic Treatment Procedures" for historic removal and dismantling.
3. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
4. Section 017300 "Execution" for cutting and patching procedures.
5. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Predemolition Photographs or Video: Submit before Work begins.

F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

G. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

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

1.8 QUALITY ASSURANCE

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

1.9 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Notify Owner for the removal of items.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.

2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

F. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

G. Storage or sale of removed items or materials on-site is not permitted.

H. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

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

1.10 WARRANTY

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

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
2. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

F. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs, preconstruction videotapes, and templates.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner and/or Building Manager will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal.

B. Work in Historic Areas: Selective demolition may be performed only in areas of the Project that are not designated as historic. In historic spaces, areas, and rooms or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 013591 "Historic Treatment Procedures."

C. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

D. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

E. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."Do not use methods requiring solvent-based adhesive strippers.

F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

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

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Existing Items and Construction to be removed to be coordinated with Owner.

B. Existing Items to Be Removed and Salvaged to be coordinated with Owner

C. Existing Items to Be Removed and Reinstalled to be coordinated with Owner.

D. Existing Items to Remain to be coordinated with Owner.

END OF SECTION

SECTION 03 11 13
CONCRETE FORMWORK

PART 1 GENERAL

1.1 WORK INCLUDED

A. Includes furnishing all materials, equipment, transportation and facilities, and performing all labor necessary for constructing concrete formwork.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification section, apply to Work of this Section.

1.3 CODES AND STANDARDS

A. The Work described in this Section, unless otherwise noted on the Drawings, or herein specified, shall be governed by the latest editions of the following codes or specifications.
1. ACI 301, Specifications for Structural Concrete of Buildings.
2. ACI 318, Building Code Requirements for Reinforced Concrete Buildings.
3. ACI 347, Recommended Practice for Concrete Formwork.
4. U.S. Product Standard for Softwood Plywood, Construction and Industrial PS- 1.
5. Timber Construction Manual, American Institute of Timber Construction.
6. Design of Wood Formwork for Concrete Structures, National Forest Products Association.

1.4 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Shop Drawings: Submit a diagram of proposed construction joints not indicated on Drawings prior to or concurrent with reinforcing steel shop drawings.
1. Shop drawings will be reviewed for proposed construction joint locations with respect to aesthetic criteria and general design conformance only.

C. Product Data: Submit complete manufacturer's product data sheets for each specified product.

1.5 DESIGN

A. The design and engineering of formwork and shoring, as well as its construction, shall be the responsibility of the Contractor.

B. Design criteria shall conform to ACI 347, Chapter 2.

1.6 ALLOWABLE TOLERANCES

A. Except when close coordination and fitting of various trades work precludes allowance of tolerance, maximum total permissible deviations from established line, grades and dimensions shall conform to ACI 347, Section 2.2.1. Set and maintain forms in such a manner as to ensure completed work within specified tolerance limits.
   1. Variation in location of embedded structural items unless provided with sleeves or other means of adjustment: 1/4".

1.7 STORAGE OF MATERIALS

A. Store form materials and accessories on dunnage and under cover with protective sheeting.

1.8 COORDINATION

A. Notify responsible trades of schedules of concrete pours so as to allow adequate time for installation and coordination of their work.

PART 2 PRODUCTS

2.1 MATERIALS

A. FORMS: Wood, metal and other approved material that will not adversely affect surface of concrete and will provide or facilitate obtaining specified surface finish:
   1. Wood forms for unexposed concrete surfaces shall be built of No. 2 Common Southern Yellow Pine Lumber or other material of equal qualifications, of sufficient thickness to be capable of sustaining the loads to be imposed thereon, dressed to uniformly smooth contact surfaces and so constructed as to be readily removable.
   2. Wood forms for exposed concrete surfaces shall be constructed of Commercial Standard Douglas Fir, moisture-resistant, concrete form plywood, not less than five (5) ply, and at least nine-sixteenths inch (9/16") thick, with one smooth face.
   3. Metal forms shall be clean, unpainted and in good condition. Forms shall at all times be straight to provide members of the widths and depths required. Damaged or indented forms will not be acceptable.
   4. Rustications, reveals and bevels in exposed concrete shown on the Drawings shall be formed with products that do not warp or lift causing fins, telegraph wood grain or in general leave less than a smooth surface that requires minimal remedial work to be suitable for the application of untextured paint.

B. Form release agent shall be non-residual, non-staining chemical release agent containing no kerosene, meeting Corps of Engineer Specification CE-204 requirements. Test for non-staining of concrete.

C. Corner Chamfer: 3/4 inch fabricated wood strip.

D. Form ties for exposed concrete surfaces shall be manufactured to allow a positive breakback of no less than one inch (1") inside the concrete surface. Ties shall be equipped with a plastic cone of not less than five-eights inch (5/8") diameter and one inch (1") long which will completely cover the hole and prevent the leakage of any mortar. Form ties for unexposed surfaces shall be bolt rods or patented devices having a minimum tensile strength of three thousand (3,000) pounds when fully assembled. Ties shall be adjustable in length and free of lugs, cones, washers or other features which would leave a hole larger than seven-eights inch (7/8") in diameter, or depressions in back of the exposed surface of the concrete. Ties shall be of such construction that, when the forms are removed, there will be no metal remaining within one inch (1") of the finished surface of the concrete.

E. Form Sealer: Synthex by Industrial Synthetics Corp., or Pre-Form by Nox-Crete Co.

F. Compressible Filler: Premolded plastic strips, non-asphaltic, ASTM D1752, Type 1.

G. Construction Joint Form: The Burke Company "Keyed-Kold Joint" or equal.

H. Vapor Retarder: 10 mil. thick Stego Wrap Class A, maximum moisture vapor permeability of 0.036 perms per ASTM E96.

I. Void Form: Sure Void Products, Inc.

PART 3 EXECUTION

3.1 MATERIAL STORAGE

A. Form material shall be delivered to the job site as far in advance of its use as is practical, and shall be carefully stacked clear of the ground in such a manner as to facilitate air drying.

3.2 INSTALLATION

A. All concrete members shall be adequately shored to safely support all loads and lateral pressures outlined in "Recommended Practice for Concrete Formwork" (ACI 347), without distortion, excessive deflection and other damage.

B. All necessary forms, centering, shores and molds shall be built to conform to the shapes, lines and dimensions of the various members of concrete construction, as shown or scheduled on the Drawings. They shall be sufficiently tight and so substantially assembled as to prevent bulging or the leakage of mortar. All forms shall be assembled to facilitate their removal without damage to the concrete.

C. Provide temporary openings at the bottom of cast-in-place walls, columns and elsewhere as required to facilitate cleaning, drainage and inspection.

D. Construct forms with such care as to produce concrete surfaces which will not have unsightly or objectionable form marks in exposed (concrete) surfaces. Lumber once used as forms shall have all contact surfaces thoroughly cleaned before reuse.

3.3 FORM TIES

A. Form ties shall be employed in such places and at such intervals as to securely hold the forms in position during the placing of concrete, and to withstand the weight and pressure of the wet concrete. Ties of a type intended to be entirely removed shall be coated with release agent to safeguard against damaging the concrete during such removal. The use of wire ties will not be permitted.

3.4 WOOD STRIPS, BLOCKING AND MOLDINGS

A. Place in the forms wood strips, blocking, molding, nailers, etc., as required to produce the finished profiles and surfaces shown on the Drawings and to provide nailing for wood members or other features required to be attached to concrete surfaces in such a manner. Coat wood strips, blocking, and moldings with release agent.

3.5 CHAMFERS

A. All exposed external angles of concrete members shall have 3/4" chamfer strips placed in the forms to relieve the angles.

3.6 FORM COATING

A. Treat forms with release agent. Wipe excess off the surface of forms, leave just oily to touch. Assure that release agent is not applied to reinforcing steel nor allowed to contact hardened concrete against which fresh concrete will be placed.

3.7 CONSTRUCTION JOINT

A. Except as otherwise specifically indicated on the Drawings, each concrete member shall be considered as a single unit of operation, and all concrete for the same shall be placed continuously in order that such unit will be monolithic in construction. Should construction joints prove to be absolutely unavoidable, the same shall be located at or near the midpoints of spans.

B. Additional construction joints shall not be made under any circumstances without prior evaluation by the Architect. All construction joints must be either plumb or level. Provide appropriate keys and dowels in all construction joints, whether horizontal or vertical.

3.8 JOINT TREATMENT

A. Gasket, plug, tape or caulk joints, gaps and apertures in exposed concrete forms to positively prevent leakage. Form joints allowed only where indicated on shop drawings. Where possible, locate joints behind rustication. Apply joint treatment within 24 hours of scheduled pour.

3.9 CLEANING

A. Immediately before placing concrete, clean forms free of chips, wire clippings and other debris.

3.10 INSERTS AND ACCESSORIES

A. Make provisions for required installation of accessories, bolts, hangers, sleeves, anchor slots and inserts cast in concrete.

B. Obtain templates or instructions for installation of items.

C. Place expansion joint fillers where detailed.

3.11 MISCELLANEOUS

A. Construct forms for any and all items of concrete work required for or in connection with the satisfactory completion of the project, whether each such item is specifically show or referred to or not.

B. Do not sleeve any columns, beams, slabs or joists unless such sleeves are indicated on the Structural Drawings, or are previously approved on Shop Drawings by the Structural Engineer.

3.12 REMOVAL OF FORMS

A. Forms shall not be removed until the concrete has adequately hardened and set. Clamps or tie rods may be loosened twenty-four (24) hours after the concrete is placed; ties, except for a sufficient number to hold the forms in place, may be removed at that time. Through wall ties that are to be wholly withdrawn shall be pulled toward the inside face of the respective wall or beam. Cutting ties back from the face of the concrete will not be permitted, and care shall be exercised to avoid spalling concrete surfaces.

B. Formwork for concrete members that support the weight of concrete shall remain in place until the concrete has reached 75% of its specified 28-day strength, unless otherwise specified or permitted.

C. Under normal conditions, the minimum period of time to be allowed to elapse before forms may be removed shall be as indicated in ACI 347, but its observance shall not operate to relieve the Contractor of the responsibility for the safety of the structure. Deviations shall be submitted to and reviewed by the Architect prior to removal of forms.

D. When the temperature falls below forty degrees Fahrenheit (40 degrees F.), the forms shall remain in place an additional period equal to the time the structure has been exposed to such lower temperature. Adequate measures shall be taken to protect the concrete from cold weather conditions.

E. Adequately reshore members subject to additional loads during construction to support both member and construction loads in a manner that will protect member from damage.

F. When reshoring is required, the operations shall be planned in advance and shall be the responsibility of the Contractor.

G. Contractor shall pay for and have Testing Laboratory make additional test cylinders to confirm strength requirements for early form recovery. Reshore before removing original shoring. Reshoring shall remain in place until members have attained required compressive strength, or as long as required to support additional construction loads.

3.13 FORM REUSAGE

A. Thoroughly clean surfaces of forms and remove nails before reuse. Do not reuse damaged or worn forms. Inspect forms and re-tighten rustications. Remove traces of joint treatment and where required for taping joints, remove traces of release agent with MEK solvent.

B. Recoat contact surfaces of forms and liners with a light spray coat of release agent. Do not apply until after joint treatment is complete.

END OF SECTION

SECTION 03 21 00
REINFORCING STEEL

PART 1 GENERAL

1.1 CODES AND STANDARDS

A. The work described in this section, unless otherwise noted on the Drawings or herein specified, shall be governed by the following Codes or Specifications:
1. ACI 301, "Specification for Structural Concrete for Buildings".
2. ACI 315, "Manual of Standard Practice for Reinforced Concrete".
3. ACI 318, "Building Code Requirements for Reinforced Concrete".
4. ASTM A185, "Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement".
5. ASTM A615, "Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement".
6. ASTM A706, "Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement".
7. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

1.2 ALLOWABLE TOLERANCES

A. Fabricating: Conform to ACI 315.

B. Placing:
1. Concrete cover to formed surfaces: Plus or minus 1/4".
2. Minimum spacing between bars: Plus or minus 1/4".
3. Top bars in slabs and beams:
a. Members 8" deep or less: Plus or minus 1/4".
b. Members more than 8" but not over 2'-0" deep: Plus or minus 1/2".
c. Members more than 2'-0" deep: Plus or minus 1".
d. Crosswise of members: Space evenly within 2" of stated separation.
e. Lengthwise of members: Plus or minus 2".

C. Maximum bar relocation to avoid interference with other reinforcing steel, conduits, or other embedded items: 1 bar diameter.

1.3 SUBMITTALS

A. Shop Drawings: Submit shop drawings and installation drawings including complete bending diagrams, assembly diagrams splicing and laps of bars, shapes, dimensions and details of bar reinforcing and accessories.
1. Show diagrammatic elevations of walls at scale large enough to clearly show position and erection marks of marginal bars, around openings, dowels, splices, etc., for these bars.

2. Show complete layout plan for each layer of reinforcing of slabs and beams showing number, arrangement, spacing, location, marking, orientation, etc. of reinforcement required for layer being described.

B. Mill Test Reports: Certified copies, evidencing compliance with the requirements of these Specifications, shall be delivered to the Architect and Engineer with all deliveries of reinforcing steel.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size, length and mark.

B. Unload reinforcing carefully to prevent damage. Store above ground in dry, well drained area and protect from mud, dirt, paint, corrosion, etc.

1.5 SCHEDULING/SEQUENCING

A. Coordinate Work of this section with work of other Sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other Sections.

PART 2 PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars: ASTM A615, new, deformed billet steel bars, domestic manufacture, Grades 60 and/or 40 as indicated on Structural Drawings. All reinforcement specifically noted as being welded shall be domestic steel conforming to ASTM A706.

B. If domestic steel reinforcing bars are unavailable, foreign bars may be used if mill certificates are submitted indicating compliance with domestic steel standards.

C. Welded Wire Fabric Reinforcing: ASTM A185, new, domestic manufacturer, steel wire spot welded at intersections and of sizes indicated.

D. Metal Accessories: Include spacers, chairs, bolsters, ties and other devices necessary for properly placing, spacing, supporting and fastening reinforcement in place, conforming to the requirements of CRSI "Manual of Standard Practice for Detailing Reinforced Concrete Structures" and ACI 315. Metal accessories shall be plastic protected where legs will be exposed in finished concrete surfaces. Plastic protection shall be the color of the concrete.

E. Bar supports for concrete resting on earth shall be precast briquettes, having tie wires embedded therein, or Individual High Chairs No. HCP with welded plates on bottom as manufactured by Hohmann & Barnard, Inc.

F. Tie Wire: FS QQ-W-461, black annealed steel, 16 ga. minimum.

2.2 FABRICATION

A. In accordance with CRSI "Manual of Standard Practice" and ACI 315.

PART 3 EXECUTION

3.1 PREPARATION

A. Cleaning: Before placing in work thoroughly clean reinforcement of loose rust, mill, scale, dirt, oil, and other coating which might tend to reduce bonding. Reinspect reinforcing left protruding for future bonding, or following delay in work, and reclean if necessary.

3.2 INSTALLATION

A. Bar Placement: In accordance with ACI 301, ACI 315, ACI 318, and CRSI "Manual of Standard Practice".

B. Bending: Bend bars cold; do not heat reinforcing or bend by makeshift methods. Discard bent, kinked or otherwise damaged bars.

C. Splices: In accordance with ACI 315 and the Contract Documents.

D. Placing: Reinforcement shall be accurately placed and securely saddle tied in accordance with CRSI recommended practice with No. 16 gauge black annealed wire, and shall be rigidly held in place during the placing of the concrete by means of metal chairs or spacers.
1. Bars in footings, beams and slabs shall be held to exact location during placing of concrete by spacers, chairs, or other necessary supports.

E. Supports: In accordance with ACI 301 and ACI 315 for number, type, spacing and placing.

F. Protection: Conform to ACI 318, Chapter 7.

3.3 WELDING

A. No welding of reinforcing steel will be permitted unless specifically indicated on the Drawings.

B. Welding of reinforcing steel shall conform to AWS D1.4.

3.4 FIELD QUALITY CONTROL

A. If reinforcing steel is purchased direct from a United States mill, manufacturer's test sheets will be sufficient. Steel supplier shall furnish mill certificate reports.

B. If steel is from an undetermined origin or manufacturer's test sheets or mill certificate reports are unavailable, perform tension and bending tests on three separate samples of each size of bar for every five tons of each type of steel as specified in the appropriate ASTM Specifications. Contractor shall furnish all material for testing and pay for all such tests.

C. Perform visual inspection prior to placement of size, type and quality of materials.

D. Observe and report on placement of reinforcement, including size, quantity, vertical location, horizontal spacing, correctness of bends, splices, clearance between bars and forms, firmness of installation, and security of supports and ties, immediately prior to concreting.

END OF SECTION

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 WORK INCLUDED

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

1.2 CODES AND STANDARDS

A. The Work described in this Section, unless otherwise noted on the Drawings, or herein specified, shall be governed by the latest editions of the following codes or specifications.

1. ACI 211.1-81, "Recommended Practice for Selecting Proportions of Normal Weight Concrete".
2. ACI 301, "Specifications for Structural Concrete for Buildings".
3. ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
4. ACI 305, "Hot Weather Concreting".
5. ACI 306, "Cold Weather Concreting".
6. ACI 309, "Standard Practice for Consolidation of Concrete".
7. ACI 311, "ACI Manual of Concrete Inspection".
8. ACI 318, "Building Code Requirements for Reinforced Concrete".
9. ASTM C33, Standard Specification for Concrete Aggregate.
10. ASTM C94, Standard Specification for Ready-Mix Concrete.
11. ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
12. ASTM C150, Standard Specification for Portland Cement.
13. ASTM C260, Standard Specification for Air-Entraining Admixtures.
14. ASTM C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
15. ASTM C494, Standard Specification for Chemical Admixtures for Concrete.
16. ASTM C595, Standard Specification for Blended Hydraulic Cements.
17. ASTM C618, Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.3 QUALITY ASSURANCE

A. Source Quality Control:
   1. Concrete production facilities shall meet the requirement for certification by the National Ready Mixed Concrete Association.
   2. Concrete batchers shall be completely interlocked semi-automatic or automatic batchers, as defined by the Concrete Plant Manufacturers Bureau.

3. Concrete batchers shall have graphic, digital, or photographic recorders, which shall register both empty balance and total weight (or volume of water or admixture) of each batched material, time to the nearest minute, date, identification of batch, and numerical count of each batch. Copies of the record shall be furnished to the Testing Laboratory.
4. The Testing Laboratory shall provide concrete batch plant inspection as specified in Section 01 45 29.

B. Concrete Mix Design Criteria:
1. Design concrete mixes in accordance with ACI 318.
2. For each concrete mix type proposed, make trial mix using aggregate proposed.
3. Determination of required average strength above specified strength shall be in accordance with ACI 318.
4. Make advance tests of trial mixes with proposed materials. Mold and cure test cylinders in accordance with ASTM C39. Do not place concrete on project until laboratory reports and results of confirmation cylinder tests have been evaluated by the Testing Laboratory and results indicate that proposed mixes will develop required strengths.
5. Testing Laboratory shall furnish the Architect with a written evaluation of each proposed concrete mix design submitted by the Contractor.
6. Check mix designs and revise if necessary wherever changes are made in aggregates or in surface water content of aggregate or workability of concrete. Slump shall be minimum to produce workable mix. Laboratory shall prescribe maximum quantity of water.

1.4 SUBMITTALS

A. Mix Designs: The Contractor shall submit proposed mix designs, including confirmation cylinder test results, in accordance with ACI 318 to the Testing Laboratory for evaluation a minimum of 14 days prior to placing concrete. Show:
1. Proportions of cement, including fly ash content, fine and coarse aggregates, and water.
2. Combined aggregate gradation.
3. Aggregate specific gravities and gradations.
4. Water-cement ratio, design strength, slump and air content.
5. Type of cement and aggregates.
6. Type and dosage of admixtures.
7. Type, color and dosage of integral coloring compounds, where applicable.
8. Special requirements for pumping.
9. Range of ambient temperature and humidity for which design is valid.
10. Any special characteristics of mix which require precautions in mixing, placing, or finishing techniques to achieve finished product.

B. Mix designs based on record of past performance in accordance with ACI 301 Method 2, may be submitted in lieu of mix designs required above, provided all necessary information is included.

C. The Contractor shall furnish duplicate delivery tickets for each load of ready-mix concrete delivered to site, in accordance with ASTM C94. Show batch weights on each ticket.

D. The Contractor shall furnish mill test reports on an as-used basis for each type and brand of cementitious material used, including fly ash.

E. The Testing Laboratory shall furnish a statistical analysis for each class of concrete placed on the project as specified in this section.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Mix and deliver concrete to project ready-mixed in accordance with ASTM C94. Mix concrete a minimum of 70 revolutions of transit mix drum at mixing speed. A minimum of 40 revolutions shall be at the production plant.

B. Schedule delivery so that continuity of any pour will not be interrupted for over 15 minutes.

C. Place concrete on site within 90 minutes after proportioning materials at batch plant.

1.6 JOB CONDITIONS

A. Hot Weather Concreting:
   1. Follow ACI 301 and ACI 305.
   2. Provide retarding type admixture conforming to ASTM C494, Type A or D in accordance with manufacturer's recommendations.
   3. Maximum concrete temperature shall not exceed 95 degrees F at time of placement.
      a. Concrete with temperatures above 90 degrees F shall be placed only if a high range water reducer (super plasticizer) is added to the mix as directed by the Testing Laboratory to maintain the specified slump during placement.

B. Cold Weather Concreting: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures.
   1. Follow ACI 301 and ACI 306.
   2. When ambient temperature at site is below 40 degrees F or is expected to fall to that temperature within ensuing 24 hours, heat water and/or aggregate prior to adding to mix so that temperature of concrete will be between 55 degrees F and 85 degrees F at time of placement.
   3. Maintain temperature of deposited concrete between 50 degrees F and 70 degrees F for minimum of seven days after placing.

C. Temperature Changes: Maintain changes in concrete temperature as uniformly as possible, but in no case exceed change of 5 degrees F per hour or 25 degrees F in any 24 hour period.

D. Combustion heaters shall not be used during the first 48 hours without precautions to prevent exposure of concrete and workmen to exhaust gasses containing carbon dioxide and/or carbon monoxide.

E. Admixtures intended to accelerate hardening of concrete or produce higher than normal strength at early periods will not be permitted unless approved by the Architect. The use of calcium chloride is specifically prohibited.

1.7 SEQUENCING/SCHEDULING

A. Coordinate Work of this Section with work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the work of other Sections.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement/Fly Ash:
1. Portland Cement, Type I or III, conforming to the requirements of ASTM C150.
2. Fly Ash, Class C, conforming to the requirements of ASTM C618. The use of Fly Ash shall be subject to review by the Architect. Where Fly Ash is used in the mix design, Fly Ash shall comprise no more than 20% by weight of the total cementitious material in the mix. Fly Ash shall not be used in floor slab.

B. Aggregate:
1. Fine: ASTM C33; clean, hard, durable, uncoated, natural sand, free of silt, loam or clay.
2. Coarse: ASTM C33; hard, durable, uncoated, gravel gradation in accordance with Size No. 467 for piers and concrete footings and Size No. 67 for all other concrete. Maximum aggregate size in accordance with ACI 318.
3. Coarse aggregate for structural lightweight concrete shall conform to the applicable requirements of ASTM C330 suitably processed, washed and screened, and shall consist of durable particles without adherent coatings. Gradation in accordance with Size Designation 3/4 inch to No.4, Table 1, ASTM C330.
4. Grading shall be in accordance with "Standard Method for Sieve Analysis of Sieve and Coarse Aggregates" (ASTM C136).

C. Water: ASTM C94, Paragraph 4.1.3; potable, clean and free from oil, acid and injurious amount of vegetable matter, alkalies, and other impurities.

D. Admixtures:
   1. Cement-dispersing, water-reducing types. Admixtures shall conform to ASTM C494, Type A or D, and shall be used strictly in accordance with manufacturer's recommendations and as determined by the Testing Laboratory. Admixture shall not discolor concrete or in any way affect the appearance of the concrete.
      a. High-range water reducing admixture conforming to ASTM C494, Type F, may be used as required and shall be one of the following types or equal:
         1. Master Builders Admixture LA-35
         2. SIKA Sikament
         3. W.R. Grace WRDA-19
   2. An air-entraining admixture conforming to ASTM C260 shall be used as required on the Drawings and shall be one of the following types or equal:
      a. Master Builders MB-VR
      b. SIKA AER
      c. W.R. Grace Darex AEA
   3. Use of calcium chloride is specifically prohibited.

E. Non-Shrink Cement Grout:
   1. Qualities: Premixed non-shrink grout requiring only addition of water. Non-metallic type grout where grout will be sight exposed.
      a. Minimum compressive strength of 5000 PSI at 7-days and 7500 PSI at 28-days when placed at a plastic consistency of 115% flow factor.
      b. Free of chloride, sulphates or gas producing agents.
   2. Standards:
      a. Overall product: CRD-C-621.
      b. Compressive Strength: ASTM C109, 2 inch cubes.
      c. Bleed Performance: CRD C-611.
      d. Flow Factor: ASTM C230.

F. Miscellaneous Structural Metals Associated with Structural Concrete:
   1. All structural steel pieces including miscellaneous structural metals placed in concrete exposed to weather, in permanent contact with soil, or accessible to salt intrusion shall be hot dipped galvanized in accordance with ASTM A123.
   2. All structural steel pieces embedded in concrete shall conform to ASTM A36, unless noted otherwise on the Drawings.
   3. Welding of inserts, anchors and other steel pieces used in conjunction with structural concrete shall conform to AWS D1.1.
   4. Welding of reinforcing steel used in conjunction with structural concrete shall conform to AWS D1.4.
   5. Headed stud anchors shall conform to ASTM A108, minimum tensile strength 60,000 PSI.
   6. Concrete expansion anchors shall be wedge-type anchors, meeting the requirements of Federal Specification FF-S-325, Group II, Type 4, Class 1, plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3. Size and location shall be as indicated on the Drawings.

7. Brick Shelf Inserts: Hohmann and Barnard, Inc., type LW-340, hot dipped galvanized with 3/4" diameter stainless steel askew head bolts.

G. Sawcut Joint Sealant - Two component elastomeric sealant.

2.2 CONCRETE MIXES

A. Strength: Concrete is classified and specified by ultimate compressive strength (f'c) at the age of 28 days.

B. Design concrete to yield strengths indicated on the Drawings.

C. Concrete permanently exposed to weather shall contain an air-entraining admixture to produce an air content in the range of 3% to 5% air by volume of concrete.

D. Proportions: Proportions of cement, aggregate, and water to attain required plasticity and compressive strength shall be in accordance with ACI 318. Do not make changes in proportions without submitting proposed changes to Testing Laboratory for evaluation.

1. Trial mixtures having proportions and consistencies suitable for the work shall be made based on ACI 211.1, using at least three different water-cement ratios which will produce a range of strengths encompassing those required for this project.
2. Trial mixes shall be designed to produce a slump within 3/4" of the maximum permitted, and for air-entrained concrete, within 0.5 percent of maximum allowable air content. The temperature of concrete used in trial batches shall not exceed the maximum temperature specified.
3. For each water-cement ratio, at least three confirmation compression test cylinders for each test age shall be made and cured in accordance with ASTM C192. Confirmation cylinders shall be tested at seven and twenty-eight days in accordance with ASTM C39.
4. From the results of the twenty-eight day confirmation test, a curve shall be plotted showing the relationship between the water-cement ratio and compressive strengths. From this curve, the water-cement ratio to be used in the concrete shall be selected to produce the average strength required.
5. The cement content and mixture proportions to be used shall be such that this water-cement ratio is not exceeded when slump is the maximum permitted. Control in the field shall be based upon maintenance of proper cement content, slump and air content.
6. Mix designs furnished by the concrete supplier, and accompanied by test data showing an acceptable strength history meeting the requirements of Method 2 as specified in section 3.8 of ACI 301, will be considered an acceptable alternative to the procedure described in paragraphs above.

a. Temperature of concrete in test data shall be within 5 degrees F of maximum temperature specified for this project.
b. Strengths indicated in test data shall be in accordance with ACI 318, paragraph 4.3.
c. The specified strength of concrete used in supporting test data shall vary no more than 500 PSI plus or minus from that specified for this project.

7. The Testing Laboratory shall keep a strength history record of all concrete for the duration of the project as specified in this section.

PART 3 EXECUTION

3.1 GENERAL

A. Inserts: Give the various trades and subcontractors ample notification and opportunity to furnish any and all anchors, nailers, pipes, conduits, boxes, inserts, thimbles, sleeves, frame vents, wires, supports, or other items required to be built into the concrete by the provisions of the Drawings or of the Specification governing the work of such trades and subcontractors, or as it may be necessary for the proper execution of their work. Obtain suitable templates or instructions for the installation of such items which are required to be placed in the forms.

B. Slump:

1. Concrete not containing a high range water reducing admixture shall not be placed when its plasticity, as measured by slump test, is outside the following limits:

Unit	Slump
Piers, footings	6" max., 4" min.
All other Concrete	5" max., 3" min.

2. Concrete containing a high range water reducing admixture shall not be placed when its plasticity, as measured by slump test, is outside the following limits:
   a. Prior to addition high range water reducer: 3 inch maximum, 1 inch minimum.
   b. After addition of high range water reducer: 10 inch maximum.

C. Classes of Concrete and Usage: Concrete of the several classes of concrete required shall have the characteristics shown on the Drawings.

D. Mixing:

1. Transit-mixed concrete conforming to the requirements of ASTM C94 and ACI 304 shall be used in lieu of concrete mixed at the job site. Concrete shall not be transported or used in any case after a period in excess of ninety (90)minutes has elapsed after the introduction of water into the mixer.
2. Indiscriminate addition of water to increase slump of concrete is prohibited. Add water only at the direction of the Testing Laboratory. No water shall be added which increases the water cement ratio of the concrete in excess of the water cement ratio indicated on the approved mix design. At the direction of the Testing Laboratory the addition of a high range water reducing admixture may be used to re-temper concrete.
3. The agency supplying transit-mixed concrete shall have a plant of sufficient capacity and adequate transportation facilities, to assure continuous delivery at the rate required. The frequency of deliveries to the site of the work must be such as to provide for placing the concrete continuously throughout any one (1) pour.

E. Conveying Concrete: Convey concrete from the mixer to the place of final deposit by methods which will prevent the separation or loss of the ingredients. Concrete to be conveyed by pumping shall be submitted to the Testing Laboratory for evaluation for each class of concrete shall be taken at the discharge end of the pumping equipment.

F. Equipment for chuting, pumping, and pneumatically conveying concrete shall be of such size and design as to assure a practically continuous flow of concrete at the delivery end without separation of the materials. The use of gravity-flow or aluminum chutes or conveyors for transporting concrete horizontally will not be permitted.

3.2 PLACING CONCRETE

A. Place concrete in reasonably uniform layer, approximately horizontal, and not more than eighteen inches (18") deep, exercising care to avoid vertical joints or inclined planes. The piling up of concrete in the forms in such a manner as to cause the separation or loss of any of its ingredients will not be permitted. Concrete which has partially set or hardened shall not, under any circumstances, be deposited in the work.

B. Place concrete in the forms as nearly in its final position as is practical to avoid rehandling. Exercise special care to prevent splashing the forms or reinforcement with concrete. Remove any hardened or partially hardened concrete which has accumulated on the forms or reinforcement before the work proceeds. Do not place concrete on previously deposited concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the respective member of section, except as hereinafter specified.

C. Do not permit concrete to drop freely any distance greater than five feet (5'). Where longer drops are necessary, use a chute, tremie, or other acceptable conveyance to assist the concrete into place without separation. Do not pour directly into any excavations where water is standing.

D. Vibration: As soon as concrete is deposited, thoroughly agitate same by means of mechanical vibrators and suitable hand tools, so manipulated as to work the mixture well into all parts and corners of the forms, and entirely around the reinforcement and inserts. Mechanical vibrators shall maintain frequencies in accordance with the recommendations of ACI 309. Table 5.1.4, and shall be operated by competent workmen. Over vibrating and use of vibrators to transport concrete within forms shall not be allowed. A spare vibrator shall be kept on the job site during all concrete placing operations.

E. Bonding: Before depositing any new concrete on or against previously deposited concrete which has partially or entirely set, the surface of the latter shall be thoroughly roughened and cleaned of all foreign matter, scum and laitance.

F. Construction Joints: Except as otherwise specifically indicated on the Drawings, each concrete member shall be considered as a single unit of operation, and all concrete for the same shall be placed continuously in order that such unit will be monolithic in construction. Should construction joints prove to be absolutely unavoidable, same shall be located at or near the midpoints of spans. Additional construction joints shall not be made under any circumstances without prior review by the owner’s representative.

G. Protect all freshly placed concrete from washing by rain, flowing water, etc. Do not allow the concrete to dry out from the time it is deposited in the forms until the expiration of the curing period.

H. Refer to structural drawings for column base plate and other structural grouting requirements.

I. Grout shall be mixed only in such quantities as are needed for immediate use. No re-tempering shall be permitted and materials which have been mixed for a period exceeding thirty (30) minutes shall in no case be used upon any portion of the work.

J. Imperfect or damaged work, or any material damaged or determined to be defective before final completion and acceptance of the entire job, shall be satisfactorily replaced at the Contractor's expense and shall be in conformity with all of the requirements of the Contract Documents. Removal and replacement of concrete work shall be done in such a manner as not to impair the appearance or strength of the structure in any way.

K. Cleaning: Upon completion of the work, all forms, equipment, protective coverings and any rubbish resulting therefrom shall be removed from the premises. Finished concrete surfaces shall be left in clean and perfect condition, satisfactory to the Owner. Sweep with an ordinary broom and remove all mortar, concrete droppings, loose dirt, mud, etc.

3.3 FIELD QUALITY CONTROL AND TESTING

A. Secure composite samples in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement.

B. All concrete shall be tested as follows:
1. Mold and cure five (5) specimens from each sample in accordance with ASTM C31.
2. Two (2) specimens shall be tested at seven days for information, two shall be tested at 28 day for acceptance, and the remaining cylinder shall be tested as directed.

C. Specimens for pumped concrete shall be taken at the discharge end of pumping equipment.

D. Any deviations from the requirements of ASTM Specifications shall be recorded in the test report. Test concrete specimens in accordance with ASTM C39.

E. Make at least one strength test (five specimens) for each 100 cu. yd. or fraction thereof, of each mix design of concrete placed in any one day. Determine slump of the concrete sample for each strength test and whenever consistency of concrete appears to vary, in accordance with ASTM C143.

F. Determine air content of air-entrained, normal weight and/or lightweight, concrete sample for each strength test, in accordance with either ASTM C231 or ASTM C173. Determine the unit weight of the concrete sample for each strength test in accordance with ASTM C138. Determine temperature of concrete sample for each strength test.

G. Inspect each batch of concrete, monitor addition of mixing water to assure uniform consistency from truck to truck. Check mixing from mixers before mix begins to set and within time limits set forth in ASTM C94.
1. Monitor addition of water to concrete at job site and length of time concrete is allowed to remain in truck during placement.
2. Certify each delivery ticket indicating class of concrete delivered, amount of water added and time at which cement and aggregate was discharged into truck, and time at which concrete was discharged from truck.

H. Should the strength of concrete fall below the minimum, then additional tests, including load tests, may be required. These tests, if required, shall be made at the Contractor's expense and shall be in accordance with ASTM C42 and ACI 318. If tests do not meet the applicable requirements, then the structure, or any part of the structure, shall be removed and replaced at the Contractor's expense.

I. Test reports shall include but not be limited to the following information: Date of concrete placement, concrete mix identification number or proportions of ingredients, truck ticket number, time test was made, time of batching, location of each placement, slump, unit weight and air content of concrete sampled and date and results of strength test.

J. Report promptly to Architect all details of reasons for rejection of any and all quantities of concrete. Give all information concerning locations of the concrete pours, quantities, date of pours, and other pertinent facts concerning concrete represented by the specimens.

K. Any concrete testing requested by the Contractor for early formwork or shoring removal, etc., shall be at the Contractor's expense.

L. Furnish a statistical analysis for each class of concrete placed on the project in accordance with ACI 214-77 and ACI 318. Information shall be updated and distributed once a month as directed by the Architect. Information shall include, but not be limited to, the following:

Strength tests at 7 days of 2 cylinder averages.
Strength tests at 28 days of 2 cylinder averages.
28-day moving average strength tests of last 3 test groups.
Standard deviation and coefficient of variation based on 28 day strength tests.
Average strength and number of 28 day tests for most recent month.

3.4 GROUT

A. For every one-third (1/3) cubic yards of grout placed, grout strength shall be tested with a set of cubes as follows:
   1. A set of cubes shall consist of three cubes to be tested at 7 days, and three cubes to be tested at 28 days.
   2. Test cubes shall be made and tested in accordance with ASTM C109, with the exception that the grout should be restrained from expansion by a top plate.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING

PART 1 GENERAL

1.1 WORK INCLUDED

A. Perform all work required to complete the Concrete Finishing indicated by the Contract Documents and furnish all supplementary items necessary for its proper execution.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 specification sections, apply to work of this section.

1.3 CODES AND STANDARDS

A. Work described in this Section, unless otherwise noted on the Drawings, or herein specified, shall be governed by the latest editions of the following codes or specifications.
1. ACI 301, "Specifications for Structural Concrete for Buildings".
2. ACI 305, "Hot Weather Concreting".
3. ACI 306, "Cold Weather Concreting".
4. ACI 311, "ACI Manual of Concrete Inspection".
5. ACI 318, "Building Code Requirements for Reinforced Concrete".
6. ASTM C309, Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

1.4 PROJECT DATA

A. Submit copies of manufacturer's literature for all products.

1.5 FINISHING TOLERANCES

A. Tolerances:
1. Construct formwork to provide concrete surfaces conforming to tolerances of Section 3.3, ACI 347.
2. Establish and maintain, in an undisturbed condition and until final completion of project, sufficient control points and bench marks to be used for reference purposed to check tolerances.
3. Regardless of tolerances specified herein, no portion of building shall extend beyond legal boundary of project.

4. Floor Finished Surface Flatness and Levelness (random traffic areas):
   a. Floor slabs shall conform to the following ACI F-number requirements:
      Slab on grade: Specified Overall Value: Ff25/fl20
      Minimum Local Value: Ff17/Fl15
   b. When tested in accordance with the requirements of ASTM E1155, the following percentages of elevation samples on a Test Surface shall fall within a level 3/4" envelope. Percentages apply to the entire Test Surface.
      Slab on grade: 90%
      The arithmetic mean of these elevation samples shall not deviate from design grade more than the following amounts:
      Slab on grade: 0.25"
   c. Floor slab shall be placed with laser screed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Liquid Membrane-Forming Curing Compound: Liquid type water based membrane-forming dissipating curing compound complying with ASTM C 309.
   1. "1100 - Clear"; W.R. MEADOWS. Curing Compound must be compatible with floor sealer.

PART 3 EXECUTION

3.1 FORMED SURFACES

A. As-Cast Rough Form Finish: Rough or board form finish surfaces shall be reasonable true to line and plane with no specific requirements for selected facing materials. Defects shall be patched and fins exceeding 1/4" in height shall be rubbed down with wooden blocks. Otherwise, surfaces shall be left with the texture imparted by the forms.

B. As-Cast Smooth Form Finish: Form facing materials shall produce a smooth, hard, uniform texture on the concrete. It may be plywood, tempered concrete-form-grade hardboard, metal, plastic, paper or other material capable of producing the desired finish. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to a practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Material with raised grain, torn surfaces, worn edges, patches, dents or other defects which will impair the texture of the concrete surface shall not be used. Tie holes and defects shall be patched. All fins shall be completely removed.

3.2 REPAIR OF DEFECTIVE AREAS

A. All honeycombed and other defective concrete shall be removed down to sound concrete. If chipping is necessary the edges shall be perpendicular to the surface or slightly undercut. No feather edges will be permitted.

B. The area to be patched and an area at least 6 inches wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared, using a mix of approximately one part cement to one part fine sand passing a No. 30 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surface.

C. The patching mixture shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the course aggregate shall be omitted and the mortar shall consist of not more than one part cement to 2 1/2 parts sand by damp loose volume.

D. White Portland Cement shall be substituted for a part of the gray Portland Cement on exposed concrete in order to produce a color matching the color of the surrounding concrete, as determined by a trial patch. The quantity of mixing water shall be no more than necessary for handling and placing.

E. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.

F. After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface.

G. To permit initial shrinkage, it shall be left undisturbed for at least one hour before being finally finished. The patched area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall which will be exposed.

H. All high points on the building slab that do not meet the required tolerance will be ground down to tolerance.

3.3 SLAB SURFACES

A. Troweled Finish:

1. The surface shall be finished first with impact power floats, then with power trowels. The first troweling after power floating shall be done by a power trowel and shall produce a smooth surface which is relatively free of defects but, which may still contain some trowel marks.

2. Additional trowelings shall be done by power trowel after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the final troweling operations.
3. The finished surface shall be free of any trowel marks and shall be uniform in texture and appearance and shall be plane to a required tolerance. High points of the finished slab, which do not meet tolerance requirements shall be removed by grinding.
4. Slab shall be cured for a minimum of seven (7) days with a spray of concrete curing compound. Curing compound shall be applied per manufacturers recommendations.
5. Slab shall be free of holes, nails, embeds or other objectionable items at completion of construction.

3.4 SCHEDULE OF FINISHES

A. As-Cast Rough Form Finish: All concrete surfaces below grade.

B. As-Cast Smooth Form Finish: All interior and exterior concrete surfaces exposed to view.

C. Troweled Finish: Floor surfaces scheduled as exposed or to receive floor covering.

D. Broom Finish: Exterior horizontal surfaces not scheduled for nonslip finish and interior surfaces scheduled to receive thin set tile.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, and services necessary for Exterior Cold-Formed Metal Framing Work indicated on the Drawings and specified herein. Work includes, but is not limited to the following:

1. Load Bearing, Structural Metal Stud Framing.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications:

1. Indoor Air Quality Requirements - Section 01 81 19. AIR BORNE PRODUCTS

2. Unit Structural Masonry - Section 04 23 0.

3. Structural Steel - Section 05 120.

4. Metal Roof Deck - Section 05 31 0.

5. Miscellaneous Metal Work - Section 05 50 00.

6. Rough Carpentry - Section 06 10 00.

7. Roof and Wall Specialties and Accessories - Section 07 70 00.

8. Aluminum Framed Entrances and Storefronts - Section 08 41 13.

9. Gypsum Wallboard - Section 09 29 00.

A. Codes and Reference Specifications: Except as otherwise specified herein, materials and workmanship shall conform to the following current codes and specifications.

1. American Institute of Steel Construction, Inc., AISC Steel Construction Manual.

2. American Welding Society (AWS):

a. D1.1, Structural Welding Code - Steel.
b. D1.3, Structural Welding Code - Sheet Steel.

3. American Iron and Steel Institute (AISI) - North American Cold-Formed Steel Specification 2001 Edition with 2004 Supplement.

4. ASTM International Standard Specifications:

   a. ASTM A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process. (Formerly ASTM Standard A446.)

   b. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

   c. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened and Bake Hardenable. (Formerly ASTM Standard A611.)

   d. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low Alloy with Improved Formability, and Ultra-High Strength. (Formerly ASTM Standard A570.)

   e. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.

5. Connections tested per American Iron and Steel Institute (AISI) Standards.

6. All applicable governing Rules, Regulations, Building Codes and Ordinances.

B. The following minimum factors of safety shall be applied to the ultimate values of fastenings:

1. Welded Connections: Per AISI and AWS.

2. Powder Driven Fasteners into Steel: 5.0.

3. Powder Driven Fasteners into Concrete: 10.0.

4. Drilled, Tapped-In, and/or Expansion Anchors: 5.0.

5. Self-Tapping Screws: 4.0.

6. Pop Rivets: 4.0.

1.03 QUALITY ASSURANCE

A. Environmental Requirements: Paint products shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC).

B. Environmental Requirements: Paint products such as touch-up field painting and isolation coatings shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC). PAINT

1.04 CERTIFICATION OF WELDERS

A. PRIOR to starting Work, furnish to the Architect, valid certification qualified by a recognized, independent laboratory, for all welders working on fabrication and erection. All welding shall be performed by welders who have qualified by tests in accordance with AWS “Standard Qualification Procedure”, to perform the type of Work required.

1.05 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner’s Representative and the General Contractor for review.

C. General: Prior to fabrication of framing, the Contractor shall submit Shop Drawings and Product Data, including fabrication and erection drawings, to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

1. Include placing drawings for framing members showing size and gauge designations, number, type, location and spacing. Indicate supplemental strapping, bracing, splices, accessories, and details required for proper installation. Design and detail all connections to structural steel, structural concrete, and/or masonry.

2. Indicate all member gauges, spacings and sizes. Sizes and spacings shown on the Drawings are minimums, Contractor shall design all members. Contractor shall increase gauge or decrease spacings to comply with actual design load requirements.

3. All Shop Drawings and calculations shall be sealed by a Professional Structural Engineer licensed in the State of the proposed Project with a minimum of five (5) years experience in the design of light gauge framing.

D. Structural Calculations: Submit full structural calculations indicating loads, stresses and deflections for members and connections.

1.06 QUALITY CONTROL

A. Testing Agency Services: Contractor may engage at his expense, a separate testing agency for information and guidance, to ascertain that all new materials are furnished, fabricated, installed, or erected in accordance with all requirements of the Contract Documents.

B. Inspection Reports: Testing agency shall send periodic reports of the findings of all inspections to the Architect, Owner, and General Contractor.

C. Defective Materials: Promptly replace all defective materials and workmanship, to the satisfaction of the Architect, at no cost to the Owner.

1.07 DELIVERY AND STORAGE

A. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

B. Delivery: Deliver to the site, all materials in protective wrappings, clearly labeled with all pertinent information to facilitate checking. Unload in areas designated by the General Contractor.

C. Storage: Store materials at the site off the ground and in properly protected dry storage facilities, until ready for use.

1.08 DAMAGE TO MATERIALS

A. Use care in storing, handling and erecting all material, and support material properly at all times to insure that no piece is bent, twisted or otherwise damaged. Material damaged due to carelessness shall be corrected at Contractor’s expense, to the approval of the General Contractor, before being erected.

1.09 SCAFFOLDING

A. Furnish, erect, and maintain all scaffolding and ladders in accordance with the standards of all governing local, state, and national safety codes. Equipment shall be erected at times and locations so as not to delay any part of Work. When no longer required, promptly dismantle equipment and remove from the site.

1.10 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period and any damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance of the installation.

PART 2 - PRODUCTS

2.01 A. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 DESIGN

A. Cold-formed metal framing systems shall be designed by a Professional Structural Engineer registered in the State of the proposed Project. Drawings for the design of the cold-formed metal framing systems and metal truss framing systems shall also be sealed by the same Engineer.

B. Design, analysis and computation of section properties shall be in accordance with the American Iron and Steel Institute (AISI) - North American Cold-Formed Steel Specification 2001 Edition with 2004 Supplement.

C. Technical tabulations of section properties and load capacities shall indicate dimensions, steel characteristics and allowable stresses upon which computations are based.

D. Framing systems shall be designed for applicable wind loads, with consideration for additional loading at eaves, corners, and overhangs.

E. Design Parameters: Refer to the Structural Drawings.

2.03 MATERIALS

A. Manufacturers:

1. Clark Western Building Systems, 101 Clark Boulevard, Middletown, OH 45044, (800)543-7140 or (513)539-2900; www.clarkwestern.com.

2. Dietrich Metal Framing, 500 Grant Street, Suite 2226, Pittsburgh, PA 15219, (412)281-2805; www.dietrichmetalframing.com.

3. Marino/Ware, 400 Metuchen Road, South Plainfield, NJ 07080, (908)757-9000 or (800)627-4661; www.marinoware.com.

B. Recycled Content of Steel Products: Provide products with an recycled content of steel so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

C. Framing Systems: Framing system shall include, but not necessarily be limited to “C” type studs and/or SJ type studs with minimum 1-5/8" flange width and 1/2" stiffening ribs, of sizes and lengths noted on Drawings, with mating runner track and required erection accessories such as strapping, and clip angles, of galvanized steel. Unless stud members of greater strength are noted on Drawings, stud members shall be of such design as to be capable of resisting wind loading designed per Building Code required in the State of the proposed Project, and in accordance with the current AISI recommendations, with a maximum allowable deflection of L/600 and a minimum of 12.5 mm (0.5 in.) deflection in either vertical direction up or down.

D. Galvanized Studs:

1. Form all 12, 14, and 16 gauge galvanized structural members from steel corresponding to the requirements of ASTM Standard A653, SQ Grade 50 (minimum yield strength 50 KSI).

2. Form all l8 and 20 gauge galvanized structural members and accessories from steel corresponding to the requirements of ASTM Standard A653, SQ Grade 33 (minimum yield strength 33 KSI).

E. Galvanizing: All studs and accessories shall be formed from steel with a G-60 Hot-Dipped galvanized coating conforming to ASTM Standards A653 and C955.

F. Fastening Devices: Materials shall include electro-galvanized self drilling, self tapping, sheet metal screws of size required by calculations, plated expansion anchors to structural substrate, of size required by calculations. Use only drilled in anchors at connections to concrete and/or masonry.

G. Physical and Structural Properties: The physical and structural properties listed by Dietrich Metal Framing, shall be considered the minimum permitted for all framing members.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 SHOP AND FIELD INSPECTION

A. Testing Agency Services: The Owner will secure the services of an unbiased, qualified, and recognized commercial Testing Laboratory, to inspect all Cold-Formed Metal Framing Work at the shop and in the field, and will pay all costs involved, except inspection costs due to reinspection of items found defective on the initial Owner sponsored inspection. Reinspection costs shall be born by the Contractor.

B. Shop Inspection shall include examination of the following Work:

1. Verify that only new materials are provided.

2. Conformance of Work with Specifications, including specified tolerances.

C. Field Inspection shall include examination of the following Work:

1. All members before erection to verify they have not been damaged in shipment, and are being properly stored on the site.
2. All members after erection to verify proper position.
3. All welds to verify proper execution, cleanliness, type, size, and strength.

D. Reports of Inspection: The Testing Laboratory shall send periodic reports of the findings of all inspections to the Architect, Owner’s Representative, and General Contractor within seven (7) days of inspection.

E. Cooperation: Contractor shall cooperate fully with the Testing Laboratory in the execution of the Testing Work.

3.03 INSPECTION

A. Examine conditions under which the Work is to be performed and notify the General Contractor in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.04 FABRICATION AND ERECTION

A. Fabricate and erect cold-formed metal framing at exterior walls and where shown on Drawings. All Work shall be in accordance with Drawings, approved Shop Drawings, manufacturer’s recommendations, and as specified herein.

B. Cut all framing components squarely, or at angle as in bracing, to fit squarely against abutting members. Firmly hold members in position until properly fastened.

C. Anchor track securely to bottom and to overhead steel framing structures as indicated on Drawings. Use butt welds or splices at all butt joints in the track.

D. Install studs at spacings indicated on Drawings. Where stud spacings are not indicated, space in accordance with manufacturer's recommendations to sustain without axial load, the design wind load and maximum deflection as specified herein or shown on the Design Drawings.

1. Seat studs squarely in the track, with the stud web and flanges abutting the track web, plumb and aligned, and securely attach to the flanges or web of both the upper and lower tracks, both sides.
2. Splices in studs will NOT be permitted.
3. Corners of stud walls shall be provided with three (3) studs minimum, located so as to provide surfaces for attachment of all interior and exterior facings.

E. Bridging shall be furnished and installed in wall systems as indicated on Drawings, and to manufacturer's specifications or recommendations.

F. Where non-structural sheathing is specified or indicated on Drawings, furnish and install lateral bracing in framing systems to manufacturer's specifications or recommendations. Where structural sheathing, such as plywood, is specified on Drawings, omit lateral bracing, except for erection purposes and stability before attachment of sheathing.

G. All accessories shall be furnished and installed as required for a complete and proper installation, in strict accordance with manufacturer's recommendations.

H. Fasten framing components with self-drilling, self-tapping screws, or by welding. Screws or welds shall be of sufficient size to insure the strength of the connection. Welds shall be fusion welds, including fillet welds, butt welds, plug welds and arc-spot welds (puddle welds), and shall be in accordance with the latest recommended procedures and practices of the American Welding Society (AWS).

I. Touch-Up Field Painting: Touch-up all damaged areas of galvanized coating, including field abrasions and welds, with zinc-rich galvanized coating repair paint according to ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings. Provide nylon/polyester or natural bristle brush application of paint product in accordance with the manufacturer's recommendations and instructions. Surfaces shall be dry, free from oil, dirt, dust, mill scale or other contaminants to ensure adequate adhesion.

1. Galvanized Coating Repair Paint: Zinc Clad® VI Water Based Organic Zinc-Rich Epoxy (VOC content of less than 105 grams/liter), as manufactured by The Sherwin-Williams® Company, Cleveland, OH, (800)321-8194; www.sherwin-williams.com.

2. Volatile Organic Compounds (VOC) Content: Touch-up primer product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

J. Isolation Coating: Wherever studs, or plates of cold-formed metal framing are to be secured to or be in contact with masonry or concrete, paint the metal contact surface with one (1) heavy coat of The Sherwin-Williams® Company “DTM Acrylic Primer/Finish, B66W1”, or comparable equivalent product subject to review by the Architect. Allow all paint to dry thoroughly prior to installation of Metal Framing Work. Exposed to view surfaces shall be clean and free of isolation coating.

1. Volatile Organic Compounds (VOC) Content: Touch-up primer product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

3.05 FIRE PREVENTION

A. Precautions: When welding and/or cutting with burning torches is required, take all precautions to prevent damage to building(s) from fire, weld spatter, dripping molten metal, smoke and fumes, or other causes arising from the operations. Provide fireproof tarpaulins or enclosures around the areas of welding or burning.

B. Equipment: Furnish adequate and sufficient fire-fighting equipment and extinguishers to prevent damage and fire at each location where welding or burning is to be done.

3.06 DAMAGE TO ADJACENT CONSTRUCTION

A. Contractor shall be responsible for any damage to adjacent construction in place, caused by the Work of this section. Repair all damage at own expense, to the satisfaction of the Architect.

3.07 CLEAN-UP

A. Work Required: Clean-up any Work soiled in the performance of the Work of this Trade.

B. Debris and Waste Materials: During progress of Work, upon completion of Work, and before final acceptance of Work, keep the premises free of debris and waste materials resulting from Framing Work. Remove debris and rubbish to area designated by General Contractor, for general clean-up by General Contractor, or if directed by General Contractor to remove from the site and legally dispose.

C. Unused Materials, Tools, and Equipment: Upon completion of Work and before final acceptance of the Work, remove unused materials, tools, and equipment from the site.

D. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 05 50 00
MISCELLANEOUS METAL WORK

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Furnish all labor, materials, equipment, apparatus, tools, transportation, protection, and services necessary for Miscellaneous Metal Work indicated on the Drawings and specified herein.

B. Examination: Carefully examine the Drawings and Specifications and include all Miscellaneous Metal Work not distinctly specified in other sections, or noted on the Drawings as being provided by other Trades.

C. Miscellaneous Metal Products: No attempt is made to enumerate or describe each item of the Work, but simply to describe major items, certain special items, and general construction requirements for all items. Work includes, but is not necessarily limited to the following:

1. Anchors.

2. Anchor Bolts and Pipe Sleeves.

3. Lintels.

4. Miscellaneous Steel Frames and Curbs.

5. Steel Ladders - furnish and install.

D. Related Sections: The following items of related Work will be provided under other sections of the Specifications:

1. Indoor Air Quality Requirements - Section 01 81 19. AIR BORNE PRODUCTS

2. Concrete Reinforcing - Sections 03 00 50 and 03 30 00.

3. Masonry Reinforcing - Section 04 23 00.

4. Structural Steel (including Roof Opening Curb Steel) - Section 05 12 00.

5. Cold-Formed Metal Framing - Section 05 40 00.

6. Rough Carpentry - Section 06 10 00.

7. Roof and Wall Specialties and Accessories - Section 07 70 00.

8. Hollow Metal Doors and Frames - Section 08 11 13.

9. Door Hardware - Section 08 71 00.

10. Gypsum Wallboard - Section 09 29 00.

11. Acoustical Panel Ceilings - Section 09 51 13.

12. Paints and Coatings - Section 09 90 00.

E. Work Furnished but not installed:

1. Items anchored (not bolted) to Concrete and Masonry Work.

2. Items as specified herein for installation by others.

1.02 DESIGN REQUIREMENTS

A. Structural Performance of Handrails and Railing Systems: Design, engineer, fabricate, and install handrails and railing systems to comply with requirements for ASTM Standard E985 for structural performance, based on testing performed in accordance with ASTM Standards E894 and E935.

B. Accessibility Guidelines: Handrails required to be accessible to persons with disabilities shall comply with Title III of The Americans with Disabilities Act (ADA), Public Law 101-336.

1.03 QUALITY ASSURANCE

A. Reference Specifications: Except as otherwise specified herein, materials and workmanship shall conform to the following current specifications as amended to date.

1. All applicable Local Building Codes and Ordinances.

2. “Specifications for Structural Steel Buildings”, and “Commentary” thereon, as adopted by the American Institute of Steel Construction, Inc. (AISC), March 9, 2005.

3. American Welding Society (AWS), D1.1, Structural Welding Code - Steel.

4. "Standard Specifications for Open Web Steel Joists" as adopted by the Steel Joist Institute (SJI) and the American Institute of Steel Construction, Inc., (AISC).

1.04 CERTIFICATION OF WELDERS

A. Current and valid certification qualified by a recognized, Independent Laboratory shall be furnished to Architect for all welders working on fabrication and/or erection PRIOR to starting Work. All welding shall be performed by welders who have qualified by tests in accordance with AWS "Standard Qualification Procedure", to perform the type of Work required.

1.05 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

C. Shop Drawings:

1. Prepare completely detailed Shop Drawings showing all items to be provided, and submit reproducibles to the Architect for review.

2. Prepare completely detailed Shop Drawings showing details for cutting, fabricating, and connecting all pieces. Do not duplicate Design Drawings for use as Shop Drawings. Duplication of Design Drawings shall be grounds for rejection.

3. Where connections are not shown on the Drawings, connections shall be designed and detailed on the Shop Drawings, and sealed by a Registered Professional Structural Engineer in the State of the proposed Project, retained and paid by the steel fabricator.

4. Provide separate Shop Drawings for erection.

5. Prepare Shop Drawings in accordance with "AISC - Detailing for Structural Steel", latest edition, using a marking system compatible with, and referenced to, the marking system used on the Design Drawings.

6. Indicate welding by using AWS symbols, showing type, size and location of all welds. Provide auxiliary views of welds as required to clarify the welded connections.

7. Formally check all Shop Drawings before forwarding to Architect.

D. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

1.06 QUALITY CONTROL

A. Testing Agency Services: Contractor may engage at his expense, a separate testing agency for information and guidance, to ascertain that all new materials are furnished, fabricated and installed in accordance with all requirements of the Contract Documents. The testing agency shall send reports of all inspections to the Architect, Owner, and General Contractor.

1.07 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance of the installation.

1.08 MATERIAL DELIVERY, STORAGE & HANDLING

A. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

PART 2 - PRODUCTS

2.01 Substitution

A. Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 MATERIALS

A. Recycled Content of Steel Products: Provide products with an recycled content of steel so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than the following:

1. W-Shapes: 60 percent.

2. Channels, Angles, M, S -Shapes: 60 percent.

3. Plate and Bar: 25 percent.

4. Cold-Formed Hollow Structural Sections: 25 percent.

5. Steel Pipe: 25 percent.

6. All Other Steel Materials: 25 percent.

C. Steel Rolled Plates and Shapes: Fabricated from new open hearth structural steel conforming to ASTM A36 - Standard Specification for Carbon Structural Steel.

D. Steel Pipe: ASTM Standard A53, Type S, Grade A, Schedule 40, unless otherwise noted.

E. Steel Tubing: Cold rolled, electric resistance welded, carbon steel, hollow, structural steel tubing, fabricated from steel having properties complying with ASTM A500 - Standard Specification for Cold- Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

F. Hi-Tensile Bolts: Heavy hex type structural bolts conforming with ASTM Standard A325, with matching heavy hex type nuts, 3/4" minimum diameter, of lengths required for connections, with hardened steel washers.

G. Standard Bolts and Anchor Bolts: Unfinished bolts conforming to ASTM Standard A307, Grade A, with hexagon heads and nuts where exposed in the finish Work.

H. Expansion Bolts: Hilti® Kwik Bolt 3 Expansion Anchor as manufactured by Hilti, Inc., 5400 South 122nd. East Avenue, Tulsa, OK 74146, (866)445-8827, (800)879-8000 or (918)252-6000; www.us.hilti.com.

1. Comparable Products: Expansion bolts by the following manufacturer with comparable products of equivalent capacity may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect’s review.

a. Power-StudÔ as manufactured by Powers Fasteners, Inc., 2 Powers Lane, Brewster, NY 10509, (800)524-3244 or (914)235-6300; www.powers.com.

I. Welding Electrodes: Series E-60 or E-70, AWS A5.1 or A5.5.

J. Galvanizing: Provide zinc coating where indicated on the Drawings. Galvanizing shall be in accordance with ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products and/or ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware, not less than 1.25 oz./sq.ft.

K. Priming Paints: Provide one (1) of the following manufacturers and products, “lead and zinc chromate free” rust inhibiting priming paint, subject to review by the Architect. Substitutions will not be permitted.

1. Manufacturers:

   a. ICI Paints, Devoe® High Performance Coatings, Strongsville, OH, (800)654-2616; www.devoecoatings.com.

   b. PPG Architectural Finishes, 400 S. 13th Street, Louisville, KY 40203, (800)441-9695; www.ppghpc.com.

   c. Tnemec, Inc., 6800 Corporate Drive, Kansas City, MO 64120, (800)863-6321; www.tnemec.com.

2. Ferrous Metal Paint Product:

   a. ICI Paints, Devoe® High Performance Coatings, DEVSHIELD™ 4130 Rust Penetrating Metal Primer, Light Gray.

   b. PPG Architectural Finishes, PPG High Performance Coatings™ (HPC), SPEEDHIDE® Int/Ext Rust Inhibitive Steel Primer 6-208 Red.

   c. Tnemec, Inc., Tnemec Primer Series 10, 99 Red.

3. Galvanized Steel Paint Product:

   a. ICI Paints, Devoe® High Performance Coatings, DEVGUARD™ 4160 Multi-Purpose Tank & Structural Primer, White.

   b. PPG Architectural Finishes, PPG High Performance Coatings™ (HPC), SPEEDHIDE® Int/Ext Galvanized Steel Primer 6-209, White.

   c. Tnemec, Inc., Hi-Build Epoxoline Series 66, White.

2.02 CONNECTIONS AND WORKMANSHIP

A. General: Weld all shop connections, bolt or weld all field connections unless otherwise noted or specified. Provide all clips, lugs, brackets, straps, plates, bolts, nuts, washers, required for complete fabrication and erection. Use connections of type and design required by forces to be resisted, and to provide secure fastening. Shop welded steel bolts shall be welded to sides and bottom of steel members, not at top of member.

B. Bolting: In bolting, draw-up bolts or nuts tight, and deform threads where possible. Use bolts of lengths required so that bolts do not project more than 1/4" beyond face of nut. Do not use washers unless specified.

C. Welding:

1. Perform all welding by the electric arc method, in accordance with the recommendations of the American Welding Society (AWS). Welds shall be solid and homogeneously a part of the metals joined, free from pits or incorporated slag or scale. Surfaces of weld shall be smooth and regular, and shall be of full area indicated or required to develop the required strength of the joint.

2. Only welders and welding operators who have been tested and certified in accordance with Appendix A, AWS D1.0, and the applicable provisions of AWS D1.0 will be permitted. All operators shall pass all applicable qualification tests while in the current and continuous employment of the fabricator or erector regardless of previous qualifications and certifications.

3. Perform all shop and field welding by the shielded metal-electric arc process. Use qualified welders. Provide all necessary jigs and holding devices for shop welding. Dog or clamp down all Work to prevent distortion during welding.

4. Design weld details and procedures so as much shop Work as possible is performed in the flat and horizontal position. Avoid undercutting, insufficient throat or leg, lack of fusion and splattering. Prepare welding procedure specifications and diagrams for each weld joint, and use in the Work. Assign each joint a procedure designation number or code. Show the number or code in the tail or each welding symbol in the Shop Drawings. Qualify non-prequalified welds in accordance with Appendix A, AWS D1.0. Where a standard weld type is repeated throughout the Work, the procedure designation or code may be indicated by general note or reference on each Shop Drawing where that weld type appears.

5. Make fillet welds larger than 5/16" in not less than two (2) passes. After each pass, remove the slag coating entirely before starting next pass. Do not use fillet welds smaller than 1/4" unless the thickness of the connected material requires

the use of 3/16" weld. Add approximately 3/4" to the theoretical length of all intermittent welds as an allowance for craters. Fill all craters.

6. Structural welds shall not be less than 3" in length unless otherwise approved on Shop Drawings.

7. Welds of all metal fabrications exposed in the finish Work shall be ground smooth, flush with adjacent surfaces, filleted at angular connections, and suitably prepared for final finish painting, unless otherwise specified.

D. Galvanized Steel Products: Field touch-up all damaged areas of galvanized coating, damaged during erection including field abrasions and welds, with zinc-rich galvanized coating repair paint according to ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings. Provide nylon/polyester or natural bristle brush application of paint product in accordance with the manufacturer's recommendations and instructions. Surfaces shall be dry, free from oil, dirt, dust, mill scale or other contaminants to ensure adequate adhesion.

1. Galvanized Coating Repair Paint: Zinc Clad® VI Water Based Organic Zinc-Rich Epoxy (VOC content of less than 105 grams/liter), as manufactured by The Sherwin-Williams® Company, Cleveland, OH, (800)321-8194; www.sherwin-williams.com

2. Volatile Organic Compounds (VOC) Content: Galvanized coating repair paint product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

E. Holes for Connections of Work by Others: Provide all holes required for the connection of the Work of other Trades where noted on the Drawings, or determined prior to fabrication of the steel.

F. Finished Work: Any Work not presenting a finished appearance will be rejected. Furnish all members true to length so assembling may be done without fillers, except where required as detailed. Trim projecting edges or corners flush where different members are assembled. All items shall be free from twists, bends, and joints. Cope, block, and miter joints carefully and neatly. Clip projecting corners. Trim all filler pieces flush.

2.03 PAINTING (SHOP AND FIELD)

A. Miscellaneous (steel) metal shall be shop prime painted and field touched-up using paint specified herein.

B. Before shop painting, thoroughly clean all surfaces of all dirt, grease, scale and rust. All surfaces not in contact but inaccessible after assembling shall have two (2) coats before assembling. Surfaces in contact after assembling need have no paint. All finished pieces shall have one (1) coat before leaving the shop.

C. After erection, clean all foreign material off the steel, and if paint is removed, repaint to meet requirements of original prime coatings.

D. After all miscellaneous (steel) metal Work has been installed and accepted, touch-up all abraded surfaces, including field bolts and welded areas.

1. Volatile Organic Compounds (VOC) Content: Field touch-up paint product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

E. Furnish the General Contractor with copies of invoice for paint, and allow manufacturer's representatives and General Contractor full access to the paint shop to inspect the paint.

2.04 ANCHORS

A. Provide anchors for miscellaneous iron members anchored into concrete or masonry. Fabricate anchors from strap iron, bent to shape, welded to backs of members, extended with bent end for building-in as conditions require, of sizes and spacing as noted. Where size and spacing are not noted, furnish 1-1/2" x 1/4" size anchors for concrete and 1-1/2" x 1/8" size anchors for masonry. Space masonry anchors properly to fit the pointing of the adjacent masonry Work. Unless otherwise noted on the Drawings, space anchors 3'-0" or less on centers.

B. Where anchors and plates or clips are to be built-in for attachment of later Work, provide bolts in the plates or clips, welded to back, with threaded ends extended as required.

C. For attaching Work to masonry or concrete, where anchors or inserts cannot be built-in, provide approved type of cinch anchors and machine bolts or screws.

2.05 ANCHOR BOLTS AND PIPE SLEEVES

A. Furnish to Masonry Contractor for installation, miscellaneous anchor bolts and pipe sleeves as indicated and required, including all markings, setting diagrams, templates. Steel Contractor shall drill all holes required for anchor bolts and through-bolts detailed not to be built-in.

B. Furnish to Concrete Contractor for installation, pipe sleeves as indicated and required, including all markings, setting diagrams, and templates.

2.06 LINTELS

A. Furnish to the Masonry Contractor for setting, all steel lintels for masonry veneers, including those required for items such as grilles, doors, ducts, wall recesses and other locations shown or required.

B. Lintels shall be rolled structural shapes of sizes noted, selected for straightness and trueness of section. Camber shall not exceedM1/8" in 10'-0".

C. Unless otherwise shown, lintels shall have a bearing of not less than 8" each side of opening.

D. Galvanize all lintels in exterior walls.

2.07 MISCELLANEOUS STEEL FRAMES AND CURBS

A. General: Furnish steel frames and curbs in accordance with the Drawings and as specified herein, to Masonry or Concrete Contractor for setting.

B. Fabrication: Steel frames for door and other miscellaneous openings, and steel curbs throughout shall be built-up of rolled steel plate or structural sections as noted, with connections to adjoining Work, and anchors for building into masonry and/or concrete. All sections shall be selected for trueness of web and flange, straightened as required so that the finished frames are uniform, square and true throughout the length and depth of the assembled units and that curbs are straight and true.

C. Assembly: Frames shall be assembled by riveting or welding, but rivets may not be used on exposed surfaces. Built-up members of frames shall be connected by means of plug welding or continuous welding. Exposed edges of member shall be welded continuously. Frames and lintel members shall be welded together where so noted and shown. All exposed welding shall be ground smooth.

D. Door Frame Jambs in Concrete or Masonry: Provide 1-1/4" x 3/16" steel strap anchors on back, vertically adjusted, 2'-0" on centers maximum for building into concrete or masonry, and clip angle at bottom for bolting into concrete; and shall be fitted with temporary spreader bars at bottom to hold frame in shape during shipping and erection.

E. Steel Frames and Curbs in Concrete Work: Provide 1-1/2" x 1/4" steel strap anchors on back, extended for building-in, spaced not over 3 ft. on centers, but not less than two (2) per side.

2.08 STEEL LADDERS

A. General: Interior steel ladders, shall be Occupational Safety and Health Administration (OSHA) approved ladders complete as detailed on Drawings. Fabricate steel ladders, as detailed with parallel side rails, of structural steel shapes indicated, and 3/4" diameter, solid, cold-rolled steel bar stock rungs spaced as shown on Drawings. Drill side rails for rungs, set rungs into rails, weld rungs solidly into rails, and grind rails smooth. Provide all steel plate brackets, washers, and fasteners, including steel angle braces, as required and detailed to install ladders in place securely.

1. Recycled Content of Steel Products: Provide products with an recycled content of steel so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

2.09 MISCELLANEOUS

A. Anchoring Cements: Products specified herein shall be as manufactured by CGM, Incorporated, 1445 Ford Road, Bensalem, PA 19020, (800)523-6570, (215)638-4400; www.cgmbuildingproducts.com, or comparable equivalent products subject to review by the Architect.

1. Exterior Use - Anchoring Cement: Super Por-Rok® Exterior Anchoring Cement, quality controlled hydraulic cement, quick-setting, pourable, non-metallic, non-shrink grout, in accordance with the following ASTM International Standard Specifications.

a. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).

b. ASTM C900 - Standard Test Method for Pullout Strength of Hardened Concrete.

2. Interior Use - Anchoring Cement: Por-Rok® Anchoring Cement, non-shrink, hydraulic controlled expansion cement.

3. Material Shelf Life: Do not retain material at the jobsite which has exceeded the shelf life recommended by the manufacturer.

B. Isolation Coatings: Paint products specified herein shall be as manufactured by The Sherwin Williams® Company, Cleveland, OH, (800)321-8194, (800)474-3794, or comparable manufacturer’s equivalent products subject to review by the Architect.

1. Aluminum Contact with Steel: Wherever aluminum items are to be secured to, or in contact with steel supporting members, paint the contact surface of the steel

with the following paint system for both the surfaces of the steel supporting members and the aluminum.

a. One (1) Prime Coat: Kem Kromik® Universal Metal Primer, B50WZ1 Off-White (VOC content of less than 420 grams/liter).

1) Volatile Organic Compounds (VOC) Content: Galvanized coating repair paint product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

b. One (1) Topcoat: TarGuard® Coal Tar Epoxy, B69B60 Black (VOC content of less than 250 grams/liter).

1) Volatile Organic Compounds (VOC) Content: Galvanized coating repair paint product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2. Aluminum Contact with Masonry or Concrete: Wherever aluminum items are to be secured to or in contact with masonry or concrete, shop paint the aluminum contact surface with the following paint product.

a. One (1) Topcoat: TarGuard® Coal Tar Epoxy, B69B60 Black (VOC content of less than 250 grams/liter).

1) Volatile Organic Compounds (VOC) Content: Galvanized coating repair paint product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

3. Brass or Bronze Contact With Steel: Wherever brass or bronze items are to be in contact with steel members, paint the contact surfaces of the steel with one (1) coat of TarGuard® Coal Tar Epoxy, B69B60 Black, (VOC content of less than 250 grams/liter).

a. Volatile Organic Compounds (VOC) Content: Galvanized coating repair paint product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

4. Condition of Painted Products: Paint coats shall be thoroughly dry prior to installation of the steel, aluminum, brass and/or bronze products. Exposed to view surfaces shall be clean and free of isolation coatings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 SETTING AND ERECTING MISCELLANEOUS METAL

A. Fabricate all items as required to be built into concrete or masonry completely, and deliver to site for installation by others. Furnish all parts complete with bolts, anchors, clips, ready to set. Deliver items to the general location of the Work. Where Work is composed of several parts, only those parts upon which anchors occur, will be set and built-in by the other Trades, ready to receive further field assembly by this Trade.

1. All Work required to be anchored entirely in concrete shall be set by the Concrete Contractor.

2. All Work required to be anchored entirely to masonry shall be set by the Mason Contractor.

3. All Work required to be anchored partially to masonry shall be set by the Mason Contractor.

B. Where necessary to secure Work to the structure by means of expansion bolts, cinch anchors, and similar connections, lay-out and install connections, install the Work and bolt up. Drill holes in Concrete and Masonry Work with rotary twist drills only.

C. Furnish, connect, and completely install all other items. Erect all items to proper lines and levels, plumb and true, and in correct relation to adjoining Work. Secure all parts in a rigid and substantial manner using concealed connections whenever practicable.

3.03 FIRE PREVENTION

A. Precautions: When welding or cutting with burning torches is required, take all precautions to prevent damage to the building(s) from fire, weld spatter, dripping molten metal, smoke and fumes, or other causes arising from the operations. Provide fireproof tarpaulins or enclosures around the areas of welding or burning.

B. Trained Personnel and Equipment: Furnish a worker trained and experienced in fire-fighting, whose sole duty shall be to prevent damage and fire at each location where welding or burning is to be done. Furnish adequate and sufficient fire-fighting equipment and extinguishers at each location.

3.04 FIELD FINISH PAINTING

A. Finish field painting of miscellaneous metal items as indicated on the Drawings and specified herein shall be by the Painting Contractor.

3.05 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Furnish all labor, materials, equipment, and services necessary for Rough Carpentry Work indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Wood Nailers, Blocking, and Plywood - furnish and install.

2. Rough Hardware - furnish and install.

B. Related Sections: The following items of related Work will be performed under other sections of the Specifications:

1. Indoor Air Quality Requirements - Section 01 81 19. AIR BORNE PRODUCTS

2. Concrete Formwork and Cast-In-Place Concrete- Sections 03 10 0 and 03 30 00.

3. Unit Structural Masonry - Section 04 23 0.

4. Structural Steel - Section 05 12 00.

5. Metal Roof Deck - Section 05 31 0.

6. Cold-Formed Metal Framing - Section 05 40 00.

7. Board Insulation - Section 07 21 2.

8. Sheet Metal Work - Section 07 60 00.

9. Aluminum Framed Entrances and Storefronts- Section 08 41 13.

10. Gypsum Wallboard - Section 09 29 00.

11. Thin-Set Tile Work - Section 09 31 00.

12. Resilient Tile Flooring - Section 09 65 19

13. Paints and Coatings - Sections 09 90 00.

14. Toilet Compartments - Section 10 21 13.

15. Plumbing Fixtures - Division 22.

1.02 QUALITY ASSURANCE

A. Wood Treatment Plants: The treatment plant shall be franchised or licensed by the specified preservative and/or retardant manufacturers as specified herein.

B. Requirements of Regulatory Agencies:

1. Grades of Lumber and Plywood: Lumber and plywood shall be as defined by the rules of the recognized association of manufacturers producing the kind or species of lumber and plywood specified herein. All lumber and plywood shall be grade stamped by the inspecting authorities.

C. Environmental Requirements: Paint products shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC).

D. Environmental Requirements: Paint products such as touch-up field painting and isolation coatings shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC). PAINT

1.03 MEASUREMENTS

A. Field Measurements: Contractor shall obtain field measurements of adjoining Work as required to locate and fit the Work of this section. Contractor shall be responsible for the accurate fitting of materials together and to the building.

1.04 SUBMITTALS

A. General: Submit Shop Drawings, Product Data, and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner’s Representative and the General Contractor for review.

C. Shop Drawings: Prepare complete Shop Drawings, showing dimensions, sections, details of materials, fabrication, and installation of materials and products. Special attention shall be given to, but not necessarily limited to the following:

D. Product Data: Include the following for review.

1. Wood Treatment Certificates for Lumber and Plywood.

2. Products specified herein under Article heading MISCELLANEOUS".

1.05 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Protection: Protect all materials from the weather during transit and during storage at the site. Store materials above the ground, in sheds if possible. If outdoor storage is required, house materials under waterproof coverings. Do not deliver materials to the job site until required for installation. Take all precautions to avoid absorption of moisture by wood and plywood.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance of the installation.

PART 2 - PRODUCTS

2.01 WOOD FOR ROUGH CARPENTRY

A. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

B. Lumber: Wood shall conform to American Softwood Lumber Standard, current edition of "Voluntary Product Standard PS20", as published by the National Institute for Standards and Technology (NIST). Grades shall conform with current grading rules of the Lumber Manufacturers Association, under whose rules the lumber is manufactured.

C. Dimension and Board Lumber: Douglas Fir. All lumber shall be "seasoned dry" (S-DRY), 19% or less moisture content.

D. Lumber Grades:

1. Boards: Douglas Fir, S4S, Standard Grade or better.

E. Wood Treatments: All dimension lumber except wood blocking and nailers at roof, shall be fire retardant treated. Wood blocking and nailers at roof and in contact with masonry shall be preservative treated.

2.02 PLYWOOD

A. Standards, Thicknesses and Grades: Plywood shall be in accordance with the National Institute of Standards and Technology (NIST) current DOC VPS Standard PS 1-95, and the quality standards of the APA-The Engineered Wood Association (formerly American Plywood Association). Thicknesses shall be as indicated on the Drawings. Grades of plywood shall be as follows for various uses, as indicated by the registered grade-trademarks of APA:

1. Plywood Sheathing: C-D EXT-APA or APA Standard with exterior glue.

2. A-C Plywood: A-C EXT-APA.

3. A-D Plywood: A-D Exposure 1 (interior exposed, such as backboards for electrical and telephone panels).

4. B-C Plywood: B-C EXT-APA (water heater platforms).

5. C-D Plywood: C-D Plugged (interior concealed).

B. Engineered Wood Products: Products shall contain no urea formaldehyde.

C. Fire Retardant Treatment: All plywood and plywood sheathing shall receive “Fire Retardant Treatment” as specified herein.

2.03 WOOD TREATMENTS

A. Manufacturer: Wood treatments required and as specified herein shall be products Equal to: Arch Wood Protection, Inc., Arch Treatment Technologies, Inc., 5660 New Northside Drive, Suite 1100, Atlanta, GA 30328, (678)627-2000; www.archchemicals.com. Manufacturers with equivalent products and treatments shall be subject to review by the Architect.

B. Wood Preservative Treatment: All wood nailers at roof parapets, and/or in contact with masonry, and elsewhere as indicated on the Drawings, shall be pressure impregnated in accordance with the specifications for treatment by Arch Wood Protection, Inc., with Wolman® CCA (Chromated Copper Arsenate) wood preservative and shall bear the Wolmanized® trademark. Treated wood shall conform to AWPA Standard P5, and have a mark certifying conformance. The treating process shall meet requirements of Fed. Spec. TT-W-571 and AWPA Commodity Standards as applicable.

C. Fire Retardant Treatment: Fire retardant treat all wood lumber, plywood and plywood sheathing by pressure treating with Dricon® fire retardant chemicals, by Arch Wood Protection, Inc. Kiln dry all pieces after treatment. Identify all treated pieces with an Underwriters Laboratories, Inc., label or marking, prior to shipment to site. Treatment shall be in accordance with the impregnating salt manufacturer's U.L. approved, specifications, and shall render the wood fire retardant to the extent that
the flame spread does not exceed 25 per ASTM Standard E84 modified to require a 30 minute test period. The treating process shall conform to the requirements of the applicable AWPA Standard C1, C2, C3, C4, C9, C14, C15, C16, C22, C23, C24, C28, C31, C33 and M4, for the species, product, preservative and end use. Preservatives shall conform to AWPA P1/P13, P2, P5, P8 and P9. Include certification by treatment plant that the treatment will not bleed through finished surfaces.

D. Certification: Submit certificates of wood treatments. Stamp or brand lumber before delivery, indicating treatment applied.

E. Exposed Wood/Field-Cuts: Surfaces of treated wood exposed by cutting or drilling at the job site shall be treated with heavy brush coat of same preservative or fire-retardant treatment used in treatment.

1. Volatile Organic Compounds (VOC) Content: Field applied preservative and fire-retardant product specified herein shall have a VOC content of 350 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2.04 ROUGH HARDWARE

A. General: Furnish all items of rough hardware such as spikes, nails, screws, bolts, anchors, brackets, etc., necessary for the installation of this Work.

1. Recycled Content of Steel Products: Provide products with a recycled content of steel so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

B. Bolts, Nuts, and Expansion Shields: Use galvanized steel bolts for all bolting Work. Use carriage bolts and nuts, or welded stud bolts and nuts for securing wood members to steel framing. Use metallic expansion shields for securing bolts to concrete. Use similar shields or toggle bolts for securing to masonry. Select length of bolts to suit thickness of material being joined.

C. Nails: Use nails conforming with Federal Spec. FF-N-105a, except as otherwise specified. Use galvanized steel nails for all Work. Zinc coating on galvanized nails shall conform with Article 3.2.1 of the Fed. Spec. Do not use aluminum nails. Except as otherwise specified, use common nails for securing of rough carpentry, use casing or finish nails, counter-set, for securing of finish carpentry.

D. Corrosion Rates: Rough hardware in contact with fire retardant treated wood shall exhibit corrosion rates less than one mil per year when tested in accordance with Fed. Spec. MIL-L-19140E, Paragraph 4.6.5.2.

2.05 MISCELLANEOUS

A. Isolation Coatings: Paint product specified herein shall be as manufactured by The Sherwin Williams® Company, McAllen, TX, or comparable manufacturer's products subject to review by the Architect.

1. Paint Product: TarGuard™ Coal Tar Epoxy, B69B60 Black.

2. Condition of Painted Products: Paint coats shall be thoroughly dry prior to installation of the steel/metal products. Exposed to view surfaces shall be clean and free of isolation coatings.

3. Volatile Organic Compounds (VOC) Content: Field applied preservative and fire-retardant product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 - Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 ROUGH CARPENTRY

A. Wood Nailers, and Blocking:

1. Neatly and accurately fit together with all necessary bolts and spikes, all wood where indicated on Drawings, such as blocking, nailers, as required to make secure.

2. Where wood blocking is required in metal stud framed walls, e.g., for support of Tenant's or Owner's fixturing, securely fasten the wood blocking to the metal stud framing at positions required, as detailed and/or noted on the Drawings. Coordinate Work with Tenant's or Owner's Representative.

3. Where wood members are to be secured to masonry, secure with 1/2" bolts with 3" hooked ends, not less that two (2) to each block, continuous nailers shall be spaced approximately 32" O.C. Bore lumber for bolts and countersink for heads.

Provide washers under all bolt heads and nuts. All nailers and cants shall be furnished in long lengths to minimize number of end joints. When joints are required, they shall be made without projecting edges.

4. Miscellaneous wood items which are built into concrete or masonry shall be delivered to the respective contractors for installation.

5. Metal roof deck flutes shall be provided with wood blocking where and as indicated on the Drawings.

B. Rough Hardware: Install all items of rough hardware as necessary for the execution of the Work.

C. Preservative Treated Wood: Install wood treated with approved preservative for wood nailers at roof parapets, and in contact with masonry. Surfaces of treated wood exposed by cutting or drilling at the job site shall be treated with heavy brush coat of same preservative as applied at the treatment plant.

D. Fire Retardant Treated Wood: Install wood that has been fire retardant treated, and in all wood blocking.

E. Plywood: Install plywood, including plywood sheathing, of thickness noted and where indicated on Drawings. All Work and nailing shall be in accordance with the recommendations of APA-The Engineered Wood Association, and with the governing code requirements.

3.03 CLEAN-UP

A. Work Required: Clean-up or repair adjacent finish Work which is soiled, marred, or damaged by the Work of this section, at Contractor’s expense.

B. Debris and Waste Materials: During progress of the Work, the premises shall be kept free of all debris and waste materials resulting from the Work of this section. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish from the site and dispose of legally. Upon completion and before final acceptance of the Work, all debris, rubbish, unused materials, tools, and equipment shall be removed from the site.

END OF SECTION

SECTION 06 16 43.20
GYPSUM SHEATHING

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications

PART1 - GENERAL

1.01 SUMMARY

A. Section Includes: Fiberglass-mat faced, moisture and mold resistant gypsum sheathing.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications:

1. Section 05 40 00 Cold-Formed Metal Framing.

2. Section 06 10 00 Rough Carpentry.

3. Section 09 21 16 Gypsum Board Assemblies.

1.02 REFERENCES

A. ASTM International (ASTM):

1. ASTM C473 Standard Test Methods for Physical Testing of Gypsum Panel Products.

2. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

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.

4. ASTM C1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

5. ASTM C1280 Standard Specification for Application of Gypsum Sheathing.

6. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

7. ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers**.**

8. ASTM E72 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.

9. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.

B. Gypsum Association (GA): GA-253 Application of Gypsum Sheathing.

1.03 QUALITY ASSURANCE

A. Environmental Requirements: Paint products shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC).

B. Environmental Requirements: Paint products such as touch-up field painting and isolation coatings shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC). PAINT

1.04 SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for each product specified.

1.05 WARRANTY

A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay).

B. Manufacturer's Warranty:

1. Five years against manufacturing defects.

2. Ten years against manufacturing defects when used as a substrate in architecturally specified EIFS.

1.06 MATERIAL DELIVERY, STORAGE & HANDLING

A. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

PART2 PRODUCTS

2.01 MANUFACTURERS

A. Georgia-Pacific Gypsum LLC:

1. Fiberglass-Mat Faced Gypsum Sheathing, Type X for Fire Rated Designs: DensGlass Fireguard Sheathing.

B. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 MATERIALS

A. Fire-Rated Fiberglass-Mat Faced Gypsum Sheathing: ASTM C1177, Type X:

1. Thickness: 5/8 inch.

2. Width: 4 feet.

3. Length: [8 feet] [9 feet] [10 feet].

4. Weight: 2.5 lb/sq. ft.

5. Edges: Square.

6. Surfacing: Fiberglass mat on face, back, and long edges.

7. Racking Strength (Ultimate, not design value) (ASTM E72): Not less than 654 pounds per square foot, dry.

8. Flexural Strength, Parallel (ASTM C1177): 100 lbf, parallel.

9. Humidified Deflection (ASTM C1177): Not more than 1/8 inch.

10. Permeance (ASTM E96): Not more than 17 perms.

11. R-Value (ASTM C518): 0.67.

12. Mold Resistance (ASTM D3273): 10, in a test as manufactured.

13. Microbial Resistance (ASTM D6329, GREENGUARD 3-week protocol): Will not support microbial growth.

14. Acceptable Products:

a. 5/8 inch DensGlass Fireguard Sheathing, Georgia-Pacific Gypsum.

2.03 ACCESSORIES

A. Screws: ASTM C1002, corrosion resistant treated.

PART3 EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

C. Verification of Conditions:

1. Inspection: Verify that project conditions and substrates are acceptable, to the installer, to begin installation of work of this section.

3.02 INSTALLATION

A. General: In accordance with GA-253, ASTM C1280 and the manufacturer's recommendations.

1. Manufacturer's Recommendations:

a. Current "Product Catalog", Georgia-Pacific Gypsum.

3.03 PROTECTION

A. Protect gypsum board installations from damage and deterioration until date of Substantial Completion.

3.04 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Furnish all labor, materials, equipment, and services necessary for Carpentry Work indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Counter Supports - furnish and install.

2. Hollow Metal Door and Frames - install.

3. Finish Hardware - install.

4. TV Wall Mount Bracket - install.

B. Color Selections: Refer to Color Legend on Drawings.

C. Door Schedule and Colors: Refer to the Drawings.

D. Related Sections: The following items of related Work will be performed under other sections of the Specifications:

1. Unit Structural Masonry - Section 04 23 0.

2. Rough Carpentry - Section 06 10 00.

3. Hollow Metal Doors and Frames - Section 08 11 13.

4. Aluminum Framed Entrances and Storefronts - Section 08 41 13.

5. Door Hardware - Section 08 71 00.

6. Gypsum Wallboard - Section 09 29 00.

7. Thin-set Tile Work - Section 09 31 00.

8. Paints and Coatings - Section 09 90 00.

9. Toilet Compartments - Section 10 21 13.

10. Signage - Section 10 14 00.

11. Toilet Accessories - Section 10 28 13.

12. Fire Protection Specialties - Section 10 44 00.

13. Miscellaneous Accessories - Section 10 80 00.

14. Plastic Laminate - Clad Countertops - Section 12 36 23.13.

15. Plumbing Fixtures - Division 22.

1.02 QUALITY ASSURANCE

A. Wood Treatment Plants: The treatment plant shall be franchised or licensed by the specified preservative and/or retardant manufacturers as specified herein.

B. Requirements of Regulatory Agencies:

1. Grades of Lumber and Plywood: Lumber and plywood shall be as defined by the rules of the recognized association of manufacturers producing the kind or species of lumber and plywood specified herein. All lumber and plywood shall be grade stamped by the inspecting authorities.

1.03 MEASUREMENTS

A. Field Measurements: Contractor shall obtain field measurements of adjoining Work as required to locate and fit the Work of this section. Contractor shall be responsible for the accurate fitting of materials together and to the building.

1.04 SUBMITTALS

A. Shop Drawings: Prepare complete Shop Drawings, showing dimensions, sections, details of materials, fabrication, and installation of materials and products. Special attention shall be given to, but not necessarily limited to the following:

1. Counter Supports.

B. Product Data: Include the following for review.

1. Wood Treatment Certificates for Lumber and Plywood.

2. Products specified herein under Article heading “MISCELLANEOUS”.

1.05 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Protection: Protect all materials from the weather during transit and during storage at the site. Store materials above the ground, in sheds if possible. If outdoor storage is required, house materials under waterproof coverings. Do not deliver materials to the job site until required for installation. Take all precautions to avoid absorption of moisture by wood and plywood.

B. Finish Hardware: The Finish Hardware Contractor will furnish all finish hardware not included in other trades, and deliver to Carpenter for storage and installation. Carpentry Contractor shall be responsible for safekeeping, furnishing templates to proper contractors, proper installation, receiving shipments and delivery of keys for hardware.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance of the installation.

PART 2 - PRODUCTS

2.01 WOOD FOR FINISH CARPENTRY

A. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

B. Lumber Grades: All lumber shall conform to, and be graded in accordance with American Lumber Standard PS-20.

1. Grading Authority Stamp: All lumber shall bear stamp of grading authority indicating compliance with specified species, grade and moisture content. Finish lumber shall be stamped on back or end where not exposed to view.

2. Dimension and Board Lumber: Douglas Fir or Pine. Maximum allowable moisture content shall be 12%.

a. Appearance Framing: 2" to 4" thick, 2" and wider shall be Douglas Fir, S4S, No. 1/Appearance.

b. Boards: 1" thick, 2" and wider shall be Douglas Fir or Pine, S4S, Superior or better.

C. Millwork and Trim: “Custom Grade” as defined in the Architectural Woodwork Quality Standards Guide Specifications, and Quality Certification Standards of the Architectural Woodwork Institute (AWI).

D. Wood Species: Unless otherwise noted on the Drawings, wood specie shall be as follows (Provide sample for approval):

1. Paint Grade Trim: Natural Birch or Poplar.

2. Stain Grade Trim: Red Oak.

3. Hardwood: Natural Birch or Poplar.

E. Engineered Wood Products: Products shall contain no urea formaldehyde.

2.02 WOOD TREATMENTS

A. Manufacturer: Wood treatments required and as specified herein shall be products Equal to: Arch Wood Protection, Inc., 1955 Lake Park Drive, Suite 100, Smyrna, GA 30080, (770) 801-6600 or (866) 873-3789. Manufacturers with equivalent products and treatments shall be subject to review by the Architect.

B. Wood Preservative Treatment: All wood nailers at roof parapets, and/or in contact with masonry, and elsewhere as indicated on the Drawings, shall be pressure impregnated in accordance with the specifications for treatment by Arch Wood Protection, Inc., with Wolman® CCA (Chromated Copper Arsenate) wood preservative and shall bear the Wolmanized® trademark. Treated wood shall conform to AWPA Standard P5, and have a mark certifying conformance. The treating process shall meet requirements of Fed. Spec. TT-W-571 and AWPA Commodity Standards as applicable.

C. Fire Retardant Treatment: Fire retardant treat all wood framing, plywood and plywood sheathing by pressure treating with Dricon® fire retardant chemicals, by Arch Wood Protection, Inc. Kiln dry all pieces after treatment. Identify all treated pieces with an Underwriters Laboratories, Inc., label or marking, prior to shipment to site. Treatment shall be in accordance with the impregnating salt manufacturer’s U.L. approved, specifications, and shall render the wood fire retardant to the extent that the flame spread does not exceed 25 per ASTM Standard E84 modified to require a 30 minute test period. The treating process shall conform to the requirements of the applicable AWPA Standard C1, C2, C3, C4, C9, C14, C15, C16, C22, C23, C24, C28, C31, C33 and M4, for the species, product, preservative and end use. Preservatives shall conform to AWPA P1/P13, P2, P5, P8 and P9. Include certification by treatment plant that the treatment will not bleed through finished surfaces.

D. Certification: Submit certificates of wood treatments. Stamp or brand lumber before delivery, indicating treatment applied.

E. Exposed Wood/ Field-Cuts: Surfaces of treated wood exposed by cutting or drilling at the job site shall be treated with heavy brush coat of same preservative or fire-retardant treatment used in treatment.

2.03 ROUGH HARDWARE

A. General: Furnish all items of rough hardware such as spikes, nails, screws, bolts, anchors, brackets, etc., necessary for the installation of this Work.

B. Bolts, Nuts, and Expansion Shields: Use galvanized steel bolts for all bolting Work. Use carriage bolts and nuts, or welded stud bolts and nuts for securing wood members to steel framing. Use metallic expansion shields for securing bolts to concrete. Use similar shields or toggle bolts for securing to masonry. Select length of bolts to suit thickness of material being joined.

C. Nails: Use galvanized steel nails for all Work. Do not use aluminum nails. Except as otherwise specified, use common nails for securing of rough carpentry, use casing or finish nails, counter-set, for securing of finish carpentry.

D. Corrosion Rates: Rough hardware in contact with fire retardant treated wood shall exhibit corrosion rates less than one mil per year when tested.

2.04 MISCELLANEOUS

A. General: Miscellaneous materials specified herein represent products from the McMaster-Carr Supply Company, P.O. Box 94930, Cleveland, OH 44101-4930, (330)995-5500, and illustrate the type, material, quality, required. Comparable products may be acceptable, subject to the Architect’s review.

1. Fastening Hardware: Provide materials such as screws, bolts, nuts, washers, nails, anchors, and miscellaneous other fastening products as required by the Drawings and/or field conditions.

B. Counter Supports:

1. Support bracket to be fully recessed 2" x 2" x 0.25" aluminum “T” extrusion, 12" x 14", as manufactured Equal to: Rangine Corp., 330 Reservoir Street, Needham, MA 02494, (800)826-6006, www.rakks.com.

2. Support angle to be 1-1/4" x 1-1/4" x 3/16" aluminum angle as supplied Equal to: McMaster-Carr Supply Co., P.O. Box 94930, Cleveland, OH 44101, (330)995-5500, www.mcmaster.com.

C. TV Wall Mount Bracket: Provide TV Mounting Bracket Anchor Kit, Part PAC-115, as recommended by Bracket Manufacturer. Bracket Manufacturer is Equal to: Chief Manufacturing. Anchor kit can be purchased online through www.Amazon.com or www.Clubmac.com.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 FINISH CARPENTRY WORK

A. General:

1. All Finish Carpentry Work shall be executed by skilled mechanics in a workmanlike manner. All joints shall be neatly and accurately made, closely fitted and assembled to remain tight and conceal any shrinkage.

2. All wood shall be well sanded to perfectly smooth surfaces, touched-up by hand and made suitable to receive paint or stain finish Work by Painting Contractor.

3. Protect all wood finishes from damage due to traffic or other construction Work, by covering with building paper and boards. Protection shall be particularly required for the jambs of openings through which material is being transported.

B. Finish Hardware: All finish hardware for wood doors and for hollow metal doors will be furnished by the Finish Hardware Contractor to Carpentry Contractor for installation. Prepare all doors to receive the hardware. Install and adjust all hardware properly, in accordance with the manufacturer's instructions. Attach and secure the hardware so that no parts are damaged or injured. Install weather stripping, door sweeps, and overhead rain drip at exterior doors.

C. Architectural Millwork: Install at locations indicated on the Drawings, all wood products as specified herein.

D. Corner Guards:

1. Project Conditions and Temperature: Materials must be acclimated in an enclosed environment of 65°-75°F for at least 24 hours prior to beginning the installation. Temperature at the time of
installation must be between 65°-75°F and be maintained for at least 48 hours after the installation.

2. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion. Do not proceed until unsatisfactory conditions have been corrected.

3. Surface Preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.

4. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

5. Installation: Install and clean corner guards in strict accordance with the manufacturer's installation and cleaning method recommendations. Use only contact cement recommended by manufacturer, and locate all components firmly into position, level and plumb.

3.03 CLEAN-UP

A. Work Required: Clean-up or repair adjacent finish Work which is soiled, marred, or damaged by the Work of this section, at Contractor's expense.

B. Debris and Waste Materials: During progress of the Work, the premises shall be kept free of all debris and waste materials resulting from the Work of this section. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish from the site and dispose of legally. Upon completion and before final acceptance of the Work, all debris, rubbish, unused materials, tools, and equipment shall be removed from the site.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, and services necessary for Insulation Work indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Furnish and Install:

a. Blanket/Batt Insulation.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Concrete Work - Section 03 30 00.

2. Masonry - Section 04 20 00.

3. Steel Roof Decking - Section 05 31 23.

4. Cold-Formed Metal Framing - Section 05 40 00.

5. Rough Carpentry - Section 06 10 00.

6. Sheet Metal Work - Section 07 60 00.

7. Joint Protection - Section 07 90 00.

8. Aluminum Window Framing - Section 08 41 00.

9. Gypsum Sheathing Panels and Gypsum Wallboard - Section 09 29 00.

1.02 QUALITY ASSURANCE

A. Environmental Requirements: Paint products such as touch-up field painting and isolation coatings shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC). PAINT

1.03 SUBMITTALS

A. Product Data: Submit three (3) sets of manufacturer's Product Data for each type of insulation specified herein.

1.04 MATERIAL DELIVERY AND STORAGE

A. Delivery: Deliver only acceptable materials to the site in original boxes and wrappings, clearly labeled with all pertinent information to facilitate checking.

B. Storage: Store materials at the site off the ground and in properly protected dry storage facilities, until ready for use. Provide a tarpaulin covering over the materials, securely tied down. Wet, damp, or damaged materials shall not be used.

C. Waste Management: Collect field generated construction waste created during construction or final cleaning in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.05 SCAFFOLDING

A. Furnish, erect, and maintain all scaffolding and ladders in accordance with applicable code requirements. Erect at times and locations so as not to delay any part of the Work, and promptly remove when no longer required.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form warranting all materials and workmanship to remain in serviceable and satisfactory condition, and make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

PART 2 - PRODUCTS

2.01 BLANKET/BATT INSULATION

A. Manufacturer: Insulation specified herein shall be as manufactured by Thermafiber, Inc., 3711 Mill Street, Wabash, IN 46992, (888)834-2371 or (260)563-2111; www.thermafiber.com.

1. Insulation: Commercial quality, inorganic and noncombustible Thermafiber® Fire Safety Blankets, open-faced with vapor barrier (foil-faced vapor retarder), unless otherwise noted on the Drawings, flame-resistant, mineral wool fiber insulation.

B. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

C. Blanket/Batt Widths: Provide as required by framing member spacings indicated on Drawings.

D. Surface Burning Characteristics: Class A fire hazard classification in accordance with ASTM Standard E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1. With Vapor Barrier: Thermafiber® FS-25 (with foil-faced vapor retarder attached), Type III, Flame Spread maximum 25, and Smoke Developed 0.

2. Without Vapor Barrier: Thermafiber® FS-15 (unfaced), Type I, Flame Spread 0, and Smoke Developed 0.

E. Vapor Retarder Facing: Foil-scrim (FSP) laminate vapor retarder shall be applied with a flameresistant adhesive. Class A flame-spread rating. Vapor retarder facing, shall have 0.02 perm rating, or better, when tested in accordance with ASTM Standard E96, Procedure A.

F. Type and Quality: Rated non-combustible as defined by National Fire Protection Association NFPA Standard 220, when tested in accordance with ASTM Standard E136. Insulation shall be nonasbestos, moisture-resistant, noncorrosive, nondeteriorating, mildew-proof and vermin-proof.

G. Thermal Resistance Values: Provide not less than R19 as unless otherwise indicated on Drawings. Thicknesses shall be as determined by manufacturer for “R” value specified. More than one layer of insulation may be used to achieve the specified “R” value.

H. Vapor Retarder Tape: Compatible with specified facer and comparable perm rating. For taping insulation joints and repairing tears.

I. Exposed Insulation: Where exposed, insulation shall meet the requirements of Factory Mutual (FM).

PART 3 - EXECUTION

3.01 BLANKET/BATT INSULATION INSTALLATION

A. General: Install blanket/batt insulation at metal stud framed exterior building walls, and other locations as indicated on Drawings.

1. Install insulation between studs, from interior side of wall recessed slightly from stud faces. Secure to studs to prevent sagging, in accordance with manufacturer's recommendations.

2. Fill voids in building construction with blanket insulation, at locations indicated on the Drawings, such as between top of concrete walls and underside of metal deck; between top of structural steel members and underside of deck, between exterior face of structural steel member and exterior construction.

3. Foil-faced batt insulation shall be furnished to the Sheet Metal Contractor for utility enclosures.

B. Vapor Retarder Installation: Seal all joints in exterior wall insulation with vapor retarder tape. Apply vapor retarder tape at intersection of insulation with framing, adjacent pieces and similar intersections to insure a vapor tight seal. Repair all tears in insulation foil facing with vapor retarder tape.

3.02 EXAMINATION

A. Refer to Section 01 31 00 - Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.03 CLEAN-UP

A. Work Required: Clean-up any Work soiled in the performance of the Work under this section.

B. Debris and Waste Materials: During progress of the Work, upon completion of Work, and before final acceptance of the Work, keep the premises free of debris and waste materials resulting from Work of this section. Remove all debris and rubbish to central area designated by the General Contractor, for general clean-up by the General Contractor, or if directed by the General Contractor to remove from the site and legally dispose.

C. Unused Materials, Tools, and Equipment: Upon completion of Work and before final acceptance of the Work, remove all unused materials, tools, and equipment from the site.

D. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 07 21 20
BOARD INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes board insulation above metal deck.

B. Related Sections:
1. Section 07260 - Vapor Retarders: Vapor retarder materials to adjacent insulation.

1.2 REFERENCES

A. ASTM C1177 – Values for Sheathing.

B. ASTM C79- Values for paper faced gypsum sheathing.

C. Gypsum Association-GA252.

D. ASTM C240 - Testing Cellular Glass Insulation Block.

E. ASTM C552 - Cellular Glass Thermal Insulation.

F. ASTM C578 - Preformed, Cellular Polystyrene Thermal Insulation.

G. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation Board.

H. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

I. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.

J. NFPA 255 (National Fire Protection Association) - Test of Surface Burning Characteristics of Building Materials.

K. UL 723 (Underwriters Laboratories, Inc.) - Tests for Surface Burning Characteristics of Building Materials.

L. ASTM C510 – Test Methods for heat flow meter.

1.3 SYSTEM DESCRIPTION

A. Materials of This Section: Provide continuity of thermal barrier at building enclosure elements.

B. Materials of This Section: Provide thermal protection to vapor retarder in conjunction with vapor retarder materials in Section 07260.

C. Materials of This Section: Provide thermal protection to air seal materials at building enclosure elements.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on product characteristics, performance criteria, limitations, adhesives and warranties.

C. Manufacturer's Installation Instructions: Submit special environmental conditions required for installation, and installation techniques.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not install adhesives when temperature or weather conditions are detrimental to successful installation.

1.6 SEQUENCING

A. Section 01100 - Summary: Work sequence.

B. Sequence Work to ensure firestopping, vapor retarder, and air barrier materials are in place before beginning Work of this section.

1.7 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with Section 07260 for installation of vapor retarder and Section 07270 for air seal materials.

PART 2 PRODUCTS

2.1 BOARD INSULATION

A. Manufacturers:

1. Rigid Board Insulation Compatible with TPO roof. Comply with R-value requirements as stated on the drawings.

2. Substitutions: Section 01600 - Product Requirements Not Permitted.

2.2 ACCESSORIES

A. Joint tape: 2" wide, 10x10 glass mesh tape.

B. Joint Compound: G-P Gypsum Corporation GyProc 90 setting type joint compound.

C. Nails, Wood Framing: Hot dip, 11-gauge galvanized nails with 7/16" head, 1 ½" min. length.

D. Screws, metal framing:

1. Type S-12, bugle head, self tapping, rust resistant, fine thread for heavy steel gauge(12 to 22).

2. Type S, bugle head, rust resistant sharp point, fine thread for light gauge metal framing or furring.

E. Screws, metal or wood framing:

1. Wafer head, rust resistant, Type S-12 drill or Hi Lo, min. 1 ¼ length. Or Type W rust- resistant, bugle head, coarse thread, sharp point for wood.

F. Sealant: Dow Corning 795 or equivalent.

G. Cellular Glass Insulation: [ASTM C552 Type IV,] cellular glass board; with the following characteristics.

1. Board Size: 4'x0" inch 8'x0".

2. Board Thickness: ½ inches.

3. Thermal Resistance: R of 0.56.

4. Compressive Strength: Minimum 40 psi.
5. Water Absorption: In accordance with ASTM C240, 0.2 percent by volume maximum.

6. Facing: Factory applied No. 15 non-perforated asphalt saturated felt complying with ASTM D226, Type 1 or equal.
7. Board Edges: square.

8. Flame/Smoke Properties in accordance with ASTM E84, UL 723, NFPA 255.

9. Facing: [Unfaced] [Faced on one side with asphalt treated mesh reinforced Kraft paper] [Faced one side with mesh reinforced aluminum foil] [Faced one side with asphalt treated mesh reinforced Kraft paper and other side with mesh reinforced aluminum foil]

10. Board Edges, square.

11. Flame/Smoke Properties in accordance with ASTM E84, UL 723, NFPA 255.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.

C. Verify substrate surface is flat, free of honeycomb, fins, irregularities, materials or substances affecting adhesive bond.

D. Preparation: Examine subframing, verify that surface of framing and furring members to receive sheathing does not vary more than ¼ " from the place of faces of adjacent members.

3.2 INSTALLATION - FOUNDATION PERIMETER

A. Adhere 4 inch wide strip of polyethylene sheet over construction joints with double beads of Type 1 adhesive each side of joint.

1. Tape seal joints.

2. Extend sheet full height of joint.

B. Apply Type 1 adhesive in three continuous beads per board length to full bed 1/8 inch thick.

C. Install boards on foundation wall, grade beam perimeter, vertically horizontally.

1. Place boards in method to maximize contact bedding.

2. Stagger [side] [end] joints.

3. Butt edges and ends tight to adjacent board and to protrusions.

D. Extend boards over control and unbonded to foundation on one side of joint.

E. Cut and fit insulation tight to protrusions or interruptions to insulation plane.

F. Sheathing: Provide Dens-Glass Gold sheathing where indicated on drawings. Install sheathing in accordance with manufacturer's, instructions and applicable instructions in GA-253 and ASTM C 1280.

G. Install Dens-Glass Gold Sheathing with gold side out.

H. Use maximum lengths possible to minimize number of joints.

I. Wood Framing: Attach Dens-Glass Gold sheathing to wood framing with nails spaced 4" o.c. at perimeter for racking shear resistance, 8" o.c. at perimeter where there are framing supports and where racking shear resistance is not required; and 8" o.c. along intermediate framing in field for both conditions.

J. Metal Framing: Attach Dens-Glass Gold sheathing to metal framing with screws spaced 8" o.c. at perimeter where there are framing supports; and 8" o.c. along intermediate framing in field.

K. Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink.

L. Locate fasteners minimum 3/8" from edges and ends of sheathing panels.

M. Joint treatment and finish preparation: 1. Painted ceilings and soffits

a. Apply joint tape over joints and embed in setting type joint compound specified.

b. Skim coat surface with setting type joint compound for smooth finish.

c. Prime and paint with exterior grade, good quality paints.

N. Building paper: 1.If required install building paper or equal with flashing around openings.

3.3 INSTALLATION - EXTERIOR WALLS

A. Adhere 6 inch wide strip of polyethylene sheet over joint with double beads of Type 1 adhesive each side of joint.

1. Tape seal joints between sheets.

2. Extend sheet full height of joint.

B. Apply Type 1 adhesive in three continuous beads per board length to full bed 1/8 inch thick. Daub adhesive tight to protrusions.

C. Install boards on wall surface, studs, horizontally. Place membrane surface of insulation against adhesive.

D. Place boards in method to maximize contact bedding. Stagger end joints. Butt edges and ends tight to adjacent board and to protrusions.

E. Cut and fit insulation tight to protrusions or interruptions to insulation plane.

F. Place 12 inch wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and doors frame. Tape seal in place to ensure continuity of vapor retarder and air seal.

G. Tape insulation board joints.

3.4 SCHEDULES

A. Perimeter Insulation: Type B, extruded polystyrene, bead adhesive application, 1/2 inch (13 mm) thick protection board.

B. Cavity Wall Insulation: Type F, semi-rigid glass fiber board, full bed vapor retarder adhesive, secured with impaling fasteners.

END OF SECTION

SECTION 07 60 00
SHEET METAL WORK

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Furnish all labor, materials and equipment necessary for Sheet Metal Work indicated on Drawings and specified herein. All edge metal and perimeter metal flashings shall be in compliance with ES-1 (ANSI/SPRI), NRCA and INTERNATIONAL BUILDING CODE (IBC 2009/CURRENT) All materials for edge metal shall be supplied and warranted by the manufacturer of the Single Ply membrane, as ES-1 Compliant. The Work includes, but is not limited to the following:

1. Base Flashing.

2. Roofers Sheet Metal and Miscellaneous Sheet Metal Work.

3. PVDF 70% (Kynar, Hylar, Trinar) coated Galvalume, 24 gauge, Grade 50 Steel.

4. Flashing Collars and Hoods.

5. Roof Vents.

6. Two-Piece Metal Counter Flashing.

7. Pressure Bars.

8. Utility Enclosures.

9. Scuppers, Receiver/Collectors, Downspouts and Perimeter Edge Metal

10. All downspouts to be seamed using Pittsburgh seaming in lieu of galvanized pop riveting.

B. Color Selections: Refer to Color Legend on the Drawings.

C. Related Sections: The following Work will be provided under other sections of the Specifications, as indicated:

1. Masonry Work - Section 04 20 00.

2. Roof Deck Openings in Roof Deck - Section 05 31 23.

3. Cold-Formed Metal Framing - Section 05 40 00.

4. Wood Blocking, Nailers, Plywood, Etc. - Section 06 10 00.

5. Thermal Insulation - Section 07 21 00.

6. Plaster Veneer System - Section 07 24 00.

7. Flexible Sheet Roofing Systems - Section 07 53 23.

8. Roof Specialties and Accessories - Section 07 70 00.

9. Exterior Field Painting - Section 09 91 13.

10. Awnings - Section 10 73 13.

11. Flashing of Plumbing Vents and Ducts Passing Through Roof - Divisions 22 and 23.

12. Prefabricated Roof Curbs and Equipment Supports - Division 23.

1.02 APPLICABLE STANDARDS - SHEET METAL WORK

A. General: All Work and materials shall conform to the requirements of the Architectural Sheet Metal Manual, Fifth Edition, (Current Edition), hereinafter referred to as “SMACNA Manual”, as issued by the Sheet Metal and Air Conditioning Contractors□□National Association.

1.03 QUALIFICATIONS OF SHEET METAL CONTRACTOR

A. Sheet Metal Contractor shall be a qualified Contracting Firm, with a minimum of five (5) years experience, capable of following the Specifications, and willing to accept instructions in the field.

1.04 QUALITY ASSURANCE

A. ES-1 Edge Standard: As called out in IBC 2009/2012 section 1504.1 … All flashings, perimeter metal, shall be in compliance with ES-1/ANSI SPRI. Manufacturer shall provide proof of compliance demonstrating as per manufacturer not by contractor shop fabrication. Manufacturer shall provide Grade 50 Galvalume AZ50 for Painted PVDF finish or AZ 55 for unpainted bare Galvalume finish.

1.05 WORKMANSHIP

A. Work shall be performed by skilled tradesmen.

B. Comply with the Contract Documents and the oral instructions of the Owner's Representative.

C. Work not fully indicated by the Contract Documents shall be done in accordance with printed instructions of the system manufacturer, or as directed by the Owner's Representative.

D. Consult the Specifications of the other Trades which connect to the Work specified herein, to become thoroughly familiar with the extent of the Work provided by others. Any items not specified under the other Trade headings, but required for completion of Work specified herein shall be provided as part of Work within this section.

1.06 SUBMITTALS

A. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

B. General: Submit Shop Drawings and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

C. Shop Drawings: Prepare complete detailed Shop Drawings showing all fabricated items and the methods of assembling, jointing, seaming and securing of Sheet Metal Work.

D. Samples: Submit two (2) 8" square Samples of factory finished sheet material, and two (2) 12" long samples of factory fabricated products.

E. Installer's Certificate: Upon completion of Sheet Metal Work, submit a written certification to the Architect and Owner, signed by the manufacturer, stating all flashing were furnished and installed in accordance with ES-1 ANSI/SPRI, IBC (current edition) or exceeding the requirements of, specifications for ten (15) year type flashing. All flashing shall be designed and installed to obtain a watertight installation and shall be warranted as a "SYSTEM WARRANTY" from the roofing manufacturer.

F. Certificates for Credit MR 7: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.

1.07 MATERIAL DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver only acceptable materials to the site in original boxes, crates, wrappings, properly packaged for protection against damage in transportation, clearly

labeled with all pertinent information, to facilitate checking. Upon receipt of materials and components, installer shall examine the shipment for damage and completeness.

B. Storage: Store and field protect materials at the site off the ground and in properly protected clean and dry storage facilities until ready for use. Stack all materials to prevent damage and to allow for adequate ventilation.

1. Roofing Felt: Rolls shall always be stored upright on pallets.

C. Handling: Exercise care in unloading, storing and installing all components to prevent bending, warping, twisting, and surface damage. Replace any damaged materials.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

1.08 MAINTENANCE CONTRACT

A. Sheet Metal Contractor shall agree to maintain the Sheet Metal Work in a weathertight and watertight condition for a period of five (5) years from the date of Owner's acceptance.

B. During the Maintenance Period, Contractor shall inspect and make immediate emergency repairs to defects or leaks in the Sheet Metal Work within twenty-four (24) hours of notice from the Owner's Representative. Within a reasonable time, restore the affected items to the standard of the original specifications. All emergency and permanent Work during the life of the contract to maintain Sheet Metal Work will be done without cost to the Owner, except in the event that leaks were caused by abuse, lightning, hurricane, tornado, hail storm or other unusual climatic phenomena of the elements, or failure of related Work (except related Roof Metal Work included under the Contract) installed by other parties.

C. Contract agreement to maintain Sheet Metal Work shall be in a written form acceptable to the Owner.

PART 2 - PRODUCTS

2.01 Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 MATERIALS

A. General: Furnish all Sheet Metal Work shown on Drawings and specified herein, except for items that are specifically noted on the Drawings or specified to be provided by others.

1. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

B. Galvalume Sheet Metal: Commercial quality coated bearing sheet steel products of not less than the US standard gauges specified below, unless otherwise noted on the Drawings. Sheet metal shall have a uniform Coating Designation AZ 50 zinc/aluminum coating applied by the continuous Hot-Dip Process in compliance with ASTM Standard A924 to both sides of the base metal. Each sheet or formed product shall bear the manufacturer's stenciled registered trade name of the product, type of base metal, gauge, and heat number. Materials shall be in compliance with Aluminum Zinc Alloy Coated Steel Sheet: Galvalume ASTM A792/A 792M-05 for lock-forming quality sheet metal.

1. Products and Manufacturer: Galvalume Steel shall be produced in accordance with ASTM A792/A 792M-05, made in America, formed and supplied by the roofing manufacturer. All steel shall be submitted and provide the proper certificate of metal materials that clearly identify manufacturer of origin for the AZ 50 or AZ 55 Galvalume.

2. Sheet Metal Products:

a. Fascia Flashing: 24 gauge (minimum) Grade 50 Galvalume, AZ 50 PVDF 70% (Kynar, Hylar or **Trinar).**

b. Metal Cleats: 16-20 gauge (minimum).

c. Gutters: 22 gauge (minimum) Grade 50 Galvalume, AZ 50 PVDF 70% (Kynar, Hylar or Trinar).

d. Braces and Brackets: Spacers and hangers shall be minimum 3/16" x 1".

e. Downspouts: 24 gauge (minimum) Grade 50 Galvalume, AZ 50 PVDF 70% (Kynar, Hylar or Trinar).

f. Metal Drip Edges: 24 gauge (minimum) Grade 50 Galvalume.

g. Flashing and Counter Flashing: 24 gauge Grade 50 Galvalume or heavier where required to meet service conditions, AZ 50 PVDF 70% (Kynar, Hylar or Trinar).

h. Break Formed Metal Trim: 24 gauge (minimum) Grade 50 Galvalume, AZ 50 PVDF 70% (Kynar, Hylar or Trinar).

i. Sheet Metal Angles: 16 gauge (minimum).

j. Conductor Heads; 24 gauge (minimum) Grade 50 Galvalume, AZ 50 PVDF 70% (Kynar, Hylar or Trinar).

C. Strainers: Provide compatible wire mesh strainer at downspout locations.

D. Sheet Lead: 2-1/2# Hard Lead Flashing and 4# Soft Lead Flashing, conforming to Federal Specification QQ-L-201, grade.

E. Steel Plates and Bar Stock: Conform to ASTM Standard A36 with galvanized finish conforming to ASTM Standard A123.

F. Pressure Bars: 1-1/2" x 1/8" thick galvanized metal with slotted holes, spaced 2" from each end and at 8" O.C., and length as required to suit conditions. Secure pressure bars with stainless steel anchor bolts and washers. Provide 1/4" wide gap between lengths of bars.

G. Flashing Collars and Hoods: Sleeved flashing collars with banded “hoods” fabricated of 24 gauge galvanized steel as detailed.

H. Roof Vents: Metal roof vents with insect screen as specified herein and caps as detailed on the Drawings. Construct vents of 6" dia., 18 gauge galvanized sheet metal with 4" flanges secured to metal roof deck and flashed into roofing.

I. Two-Piece Metal Counter Flashing:

1. Manufacturer: The Roofing Manufacturer shall provide the reglet as per architectural drawings as a 2 piece compression (spring locked) assembly, warranted, designed and engineered by the roofing manufacture and made part of the System Watertight Warranty.

2. Product: Prefabricated, two-piece flashing system shall not be less than 24 gauge Grade 50 Galvalume standard zinc/aluminum AZ 50 finish and Kynar 70 PVDF coating to match architects selected colors. Provide type as required by Drawings, subject to review by the Architect. Provide ES 1 Compliance documentation in conjunction with IBC Code following ANSI/SPRI and International Building Code section 1504.1 of the IBC code for edge metal. (current IBC edition)

J. Insect Screens: Epoxy coated wire mesh product, 18 x 14 mesh, 0.009 wire diameter, 0.09 lb./sq. ft., with 72% free open air area, as manufactured by McNichols Co., 2502 North Rocky Point Drive, Suite 990, Tampa, FL 33607-1447, (813)282-3828, (800)237-3820; www.mcnichols.com, or comparable equivalent product, subject to review by the Architect.

K. Building Felt: Type II, No. 30, un-perforated asphalt-saturated roofing felt conforming to ASTM Standard D226.

L. Fasteners: #10 x 1-1/4" min. hex head screws, heavy cadmium plated steel, or stainless steel, and neoprene sealing washers not less than 3/4" O.D.

M. Sealants:

1. Roofing Materials Sealant: Provide sealant compatible with roofing system, as recommended by the specified roofing manufacturer, subject to review by the Architect.

2. Metal Joint Sealant:

a. Manufacturer: Roofing Manufacturers Sealants, made part of the watertight warranty or Tremco, Incorporated, Commercial Sealants & Waterproofing Division approved and warranted by roofing manufacturer.

b. Product: Conforming to Manufacturers system warranty and/or matching the performance standards of Mono® 555, one-part Acrylic Terpolymer Sealant, meeting U.S. Federal Specification TT-S-230, or other equivalent product subject to review by the Architect. Color selection shall be by Architect.

c. Volatile Organic Compounds (VOC) Content: paint and coatings product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2.03 FINISHES

A. Field Painted Metal Products: Galvalume metal products AZ 50 aluminum zinc coated with 70 PVDF finish to match selection made by the architect. Touch up shall be in strict compliance of the manufacturer guidelines for 70% PVDF finishes.

B. Prefinished Metal Products: Galvalume Grade 50 prefinished metal products shall have a factory-applied, primed, and oven-baked finish based of Kynar Polyvinylidene Fluoride (PVDF) resin by Akzo Nobel, Valspar, PPG or Arkema, Inc. Finish shall be a dispersion coating based on a minimum of 70% Kynar 500®/Hylar 5000®, Trinar® or Fluropon® resins, in strict compliance with the standards for 70% PVDF finish and meeting Energy Star requirements. This finish shall be in strict accordance with the licensed formulator's specification and applied by an applicator approved by the licensed formulator. This finish, based on Kynar 500® resin, Trinar®, Hylar 5000® or Fluropon® shall meet the performance criteria of AAMA 2605 specification and be certified by the formulator as containing PVDF 70% resin manufactured by Akzo Nobel, Arkema, Valspar, PPG. Primer shall have a dry film thickness of 0.2 to 0.4 mils. Topcoat dry film thickness shall be not less than .09 to 1.3 mil thickness on the exposed finished surface of the metal product. Dry film thickness shall be in accordance with ASTM D7091 - Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to

Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals (formerly ASTMStandard D1400).

1. Application: 70% PVDF resin-based coating application method to substrates shall be in accordance with Authorized Licensee's recommended mil thickness, subject to review by the Architect.

2. Colors: As indicated on the Drawings or selected by the Architect.

    a. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

    b. PVDF Testing Standards as listed:

PAINT FINISH TESTING:

Abrasion	ASTM D 968
Accelerated Weathering	ASTM D 822, ASTM-G153
Acid Resistance	ASTM D 1308
Chalk	ASTM D 4214 Method A
Cleveland Condensing	ASTM D 4585
Color Change	ASTM D 2244
Cross Hatch Adhesion	ASTM D 3359
Cure Test	ASTM D 5402
Cyclic Salt Fog/UV	ASTM D 5894
Direct/Reverse Impact	ASTM D 2794
Fire Hazard	ASTM E 84
Florida Exterior	ASTM D 2244/ASTM D 4214 Method A
Gloss	ASTM D 523 60°
Humidity Resistance	ASTM D 2247
Mandrel Bend	ASTM D 522 1T, 2T, 3T
Pencil Hardness	ASTM D 3363
Salt Spray	ASTM B 117
Sulfur Dioxide	ASTM G 87 (aka Kesternich Test)
Water Immersion	ASTM D 870

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 WORKMANSHIP - SHEET METAL WORK

A. Work shall be accurately formed to sizes, shapes and dimensions indicated and detailed, with all angles and lines in true alignment. All Work shall be straight, sharp, and erected plumb and level in proper plane without bulges or waves. Form sheets with a bending brake to the profiles detailed. Shaping and hand seaming shall be shop processed insofar as practical. AND ES1 COMPLIANT, supplied, manufactured, engineered by the roofing manufacturer, made part of the warranted roof system.

B. Fabricate and erect all Sheet Metal Work to perform satisfactorily.

C. Fabricate all items in maximum lengths and hold all joints to a minimum.

D. Cooperate with all other subcontractors, and arrange for installation of sheet metal in connection with their Work.

3.03 INSTALLATION OF FLASHING AND SHEET METAL WORK

A. Flashing Collars and Hoods:

1. Where pipe or conduit extends through roof, and where other similar roof penetrations occur, furnish and install flashing collars for all locations as shown on Drawings. Furnish assemblies complete, including top “hood” portions, copper tension straps and non-corrosive bolts.

2. Flashing collars shall be fabricated with galvanized sheet iron, consisting of a 3" diameter seamed tube (larger diameter if required by size of item penetrating roof), min. 8" high with a 4" wide circular flange at the bottom. Flashing collars to be one piece, but, if joined in field shall be soldered completely tight including flange. Provide separate top “hood” portion, fabricated from galvanized sheet metal to shape indicated on Drawings. Provide each “hood” portion with a galvanized steel tension strap, for securing “hood”, and brass or stainless steel bolt for securing strap.

3. Install the flashing assemblies by securing collar flanges to roofing, embedding in cement over top ply of roofing, and sealing with sealant as per detail.

4. At each flashing collar with sleeve, install top “hood” portion in approved elastic compound, place tension straps in position, and bolt same tightly in place. Seal top portion of “hood” by filling with flared out portion of “hood” with plastic sealant.

B. Prefinished Galvanized Metal Fascia Flashings:

1. Furnish and install prefinished galvanized metal fascia flashings, formed to shapes as shown on Drawings.

2. Fascia flashings shall be same as shown at FIGURE 2-1B, FORMED GRAVEL STOP FASCIA - DESIGN DATA, of SMACNA Manual, to fit into continuous sheet metal cleats of metal compatible with the galvanized metal secured to wood blocking at top of wall. All nailing shall be concealed.

   a. Nail continuous cleats to the wood blocking at 10" O.C. and in compliance with ES -1(wood blocking by Rough Carpentry Trade). Form bottom edges of cleats out at a 45° angle, to fit drip shape of flashing. Install a continuous, single layer of waterproof building paper (conforming to ASTM Standard C171) over blocking and cleats, trimmed so that it will not be visible when coping is installed.

   b. Form flashings in 10 ft. long sections, and joined to allow for longitudinal expansion. Stiffen free ends (bottom edges of vertical sides) of flashing by seaming back 1/2", and bending out 1/2" to form drip. Lock flashings into continuous cleats at face side of wall and fasten to wood blocking with screws at 2'-0" O.C. Overlap sections at joints a minimum of 4".

   c. Corners of all flashings shall be mitered, seamed, and sealed.

C. Kynar 70% PVDF finish Gutters, Downspouts and Gravel Stops:

1. Fabricate and install prefinished gutters and downspouts as detailed on Drawings and specified herein.

2. Hanging gutter installation shall conform to similar detail at FIGURE 1-12 – HANGING GUTTER INSTALLATIONS - GENERAL of SMACNA Manual, and shall consist of continuous cleat, gutter, gutter spacer, and gutter brackets as shown on Drawings.

3. Fabricate gutter of Galvalume AZ50 Grade 50, PVDF 70% coating in Rectangular Type Gutter Style, per “Style I” shown on FIGURE 1-2 RECTANGULAR TYPE GUTTER STYLES OF SMACNA Manual, and as detailed on the Drawings.

4. Furnish and install strainers, inserted into downspout inlets. Furnish and install all outlet tubes, and gutter ends.

5. Furnish and install downspouts of plain round design as detailed on the Drawings, fabricated of galvanized sheet steel, in sizes and locations shown on the Drawings.

6. Fabricate downspout hanger according to FIG 1-35D, FIGURE 1-35, DOWNSPOUTS - HANGER DESIGN of SMACNA Manual. Secure downspouts with hangers to wall at 6 ft. centers, maximum.

7. All fasteners and accessories shall be of compatible material.

8. Gravel Stops: Fabricate perforated gravel stops of 12 gauge galvanized sheet, in lengths not exceeding 10 ft. Install stops, at gutters, over prepared nailer onto roof, and secured with neoprene-washered large-head stainless steel nails in 2 rows staggered with nails 6" apart each row, giving an actual 3" separation between fastenings. Lap each length 2", and drive 2 nails into each lap.

9. Conductors/Collectors/Receivers shall be custom fabricated to match the opening at the through wall scupper. The Scupper shall provide for a weld between the roof membrane, and the membrane through the wall at the scupper. The scupper shall provide a monolithic connection, manufactured and warranted by the membrane manufacturer.

D. Utility Enclosures:

1. Furnish and install curb mounted, two-piece, enclosure type, and 20 gauge galvalume sheet metal flashings to cover locations where pipes and conduit penetrate the roof. Furnish complete enclosure assemblies, including sheet metal screws.

2. Fabricate two-piece enclosure assembly as detailed on Drawings. Bottom section shall be 12" high, square sleeve sized to fit on roof curb, with slots at one side of sleeve to fit over the utility lines, and closure piece at same side, similarly slotted to fit over utility lines, covering former slots. Fabricate removable top section as cover to fit over bottom section, with drip formed edges on all sides, and projecting hood portion at side with sheet metal slotted sleeve sheets fitted over utility line penetrations to form a weathertight seal around the pipes.

3. Fit and install bottom section on roof curb, securing with screws and neoprene/metal washers. Receive foil face batt insulation from Thermal Insulation Contractor. Install insulation as indicated on the Drawings with the foil face down. Fit top section down over bottom section, securing with sheet metal screws spaced 8" O.C.

E. Metal Drip Edges: Brake-form prefinished galvanized sheet metal to provide 3-inch roof deck flange and 1-1/2 fascia flange with 3/8-inch drip at lower edge. Furnish in lengths of 8 to 10 feet.

F. Miscellaneous Flashing and Sheet Metal Work: Complete all Miscellaneous Flashing and Sheet Metal Work indicated or required, whether or not specified herein.

G. Pitch Pockets: PITCH POCKETS ARE PROHIBITED.

3.04 ROOF VENT INSTALLATION

A. Install vents through roof where shown on the Drawings. Coordinate with Roofing Contractor. Final flashing shall be by Roofing Contractor.

3.05 REPLACEMENT

A. Promptly replace all defective materials and workmanship, at no cost to the Owner, to the satisfaction of the Architect.

3.06 PAINTING

A. Field Painting: Finish painting of materials where required by Drawings and/or field conditions shall be by the Painting Contractor.

B. Prefinished Materials:

1. Touch-up prefinished items damaged during installation and in 100% compliance of PVDF provider.

2. Paint shall be 70% PVDF and color to match factory-applied shop finish.

2.02 Kynar/Hylar/Trinar/Fluropon Polyvinylidene Fluoride (PVDF) finish surface imperfections or minor scratches shall be touched-up using a coating based upon 70%PVDF resin as supplied by Licensee.

B. Compatibility: Paint shall be compatible with roofing materials.

3.076 CLEAN-UP

A. Work Required: Clean-up any Work soiled in the performance of Work under this section.

B. Debris and Waste Materials: During progress of the Work the premises shall be kept free of all debris and waste materials resulting from the Work of this section. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish from the site, and dispose of legally.

C. Unused Materials, Tools, and Equipment: Upon completion and before final acceptance of the Work, remove all unused materials, tools, and equipment from the site.

D. Waste Management: Collect field generated construction waste created during construction or final.

END OF SECTION

SECTION 07 70 00
ROOF AND WALL SPECIALTIES AND ACCESSORIES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Furnish and/or provide all material and equipment necessary for Roof and Wall Specialties and Accessories indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Safety Posts.

2. Pipe Supports.

3. Pipe Flashings.

4. Walkway Roof Pads.

B. Color Selections: Refer to Color Legend on the Drawings.

C. Related Sections: The following items of related Work will be provided under other sections of the Specifications:

1. Framing for Roof Openings - Section 05 12 00.

2. Roof Openings in Steel Roof Decking - Section 05 31 23.

3. Steel Roof Access Ladders - Section 05 50 00.

4. Rough Carpentry - Section 06 10 00.

5. Roof Flashings - Section 07 60 00.

6. Finish Hardware for Roof Hatches - Section 08 70 00.

7. Exterior Finish Painting - Section 09 91 13.

8. Prefabricated Roof Curbs - Division 23.

1.02 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Shop Drawings: Prepare and submit complete Shop Drawings, indicating product construction, installation details, and control dimensions to allow for accurate preliminary framing and installation procedures.

C. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

1. Certificates for Credit MR 7: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.

1.04 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Delivery: Deliver all products, materials, and accessories at location designated by the General Contractor.

B. Storage: Store all products and materials at the site above the ground. Cover all materials with waterproof coverings to prevent water absorption from rain and condensation. Handle all materials to prevent damage. Materials shall not be dumped in piles or placed directly on ground.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.05 WARRANTY

A. General: Submit Shop Drawings and Product Data to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Form of Warranty: Execute a warranty in the approved written form warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or repairing imperfections. The warranty period shall be not less than five (5) years from date of Owner's acceptance of installation.

PART 2 - PRODUCTS

2.01 Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.03 SAFETY POSTS

A. Manufacturer: The Bilco Company, P.O. Box 1203, New Haven, CT 06505, (203)934-6363; www.bilco.com.

B. Model: Bilco® Model LU-1 LadderUP® Safety Post, fully factory assembled, complete with adjustable mounting hardware and fasteners for securing to rungs of fixed ladder in accordance with the manufacturer's instructions.

C. Material and Finish: Manufacturer's standard, steel, safety yellow powder coat finish.

D. Construction: Safety post shall be manufactured of high strength steel with telescoping tubular section that locks automatically when the operator opens the roof hatch and raises the post to its fully extended position above the roof level. Upward and downward movement shall be easily controlled by a stainless steel spring balancing mechanism with a release lever to allow the post to be returned to its original lowered retracted position.

2.04 PIPE SUPPORTS

A. Preformed Roller Bearing Pipe Supports:

1. Manufacturer: Miro Industries, Inc., 2700 South 900 West, Salt Lake City, UT 84119, (800)768-6978, (801)975-9993; www.miroind.com.

2. Product: Where required by Drawings and/or field conditions, furnish Models 3-R-2 and/or 3-R-4 Polycarbonate Pillow Block Pipestand, and "Pipe Straps" where required by code.

a. Accessories: Provide as required by field conditions, manufacturer's associated stackable 3-R Spacers.

B. Pipe Support Product Verification: Contractor shall verify pipe support products as indicated on the Drawings and/or specified herein for coordinated size requirements in order to provide actual physical contact and support of pipes as required. Report to the Architect in writing, any discrepancies from Specifications and Drawings, and actual conditions at the site.

C. Comparable Products: Manufacturers will comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review.

2.05 PIPE FLASHINGS

A. Manufacturer: Pipe flashings specified herein shall be as manufactured by Portals Plus, Commercial Products Group of Hart & Cooley, Inc., 815 Kimberly Drive, Carol Stream, IL 60188, (800)624-8642.

1. Flashing System - Single or Multiple Pipe Penetrations: Where required by Drawings and/or field conditions, furnish factory fabricated flashing system for single or multiple pipe penetrations of built-up roofing systems or single ply roofing systems shall be Portals Plus, "Quadraseals and Pipe Boots". Flashing shall be molded of 60 mil (0.060") thick EPDM, Neoprene or Hypalon and shall be ozone and ultraviolet resistant, with a serviceable temperature range of -60F° to +270°F minimum. Base flange shall be feather edged, and unit shall include conically shaped steps with molded ribs and stainless steel clamps.

2. Curb Mounted Pipe Flashing System: Where required by Drawings and/or field conditions, furnish factory fabricated, curb mounted pipe flashing system for single or multiple pipe penetrations through single ply roofing. Pipe flashing system shall be Portals Plus, "Pipe Portal® Systems". System shall include prefabricated roof curb, laminated acrylic coated ABS plastic curb cover with prepunched mounting holes and molded sealing rings on the collar opening, and an EPDM compression molded rubber cap, and stainless steel clamps.

B. Pipe Seal: Where required by Drawings and/or field conditions, furnish factory fabricated combination flashing and sealing assembly shall include one-piece spun aluminum base with roof surface flange, sloped where required, with graduated step PVC boot, and adjustable stainless steel clamps. Manufacturer: pate® pipe seal assemblies (pps-size as required) by The Pate Company, 245 Eisenhower Lane South, Lombard, IL 60148, (800)243-3018 or (630)705-1920.

C. Comparable Products: Pipe flashing by manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review.

2.06 WALKWAY ROOF PADS

A. EPDM Roofing System: Protective membrane walkway roof pads for use on EPDM Roofing Systems shall be "GenFlex FlexGuard™ Peel & Stick™ Walkway Pads" as manufactured by GenFlex Roofing Systems, 250 West 96th Street, Suite 150, Indianapolis, IN 46260, (800)443-4272. Pads shall be compatible and acceptable with the roofing system manufacturer.

1. Prefabricated walkway pads on roof areas as shown on the Drawings, and for use as a protective membrane with roof accessories, shall be 30" x 30" x 5/16" thick unless otherwise indicated.

2. Comparable product shall be subject to the Architect's review.

3. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 INSTALLATION

A. General: Unless otherwise specified, furnish to the Roofing Contractors all roof specialties and accessories as indicated on the Drawings and specified herein, complete with all required sealants, anchoring devices, and miscellaneous accessories in accordance with manufacturer's recommendations. Unless otherwise noted on the Drawings, furnish all shimming accessories of materials compatible with roof construction.

B. Safety Posts: Provide factory assembled safety posts and all required bolts and fasteners for installation to steel roof access ladder as indicated on the Drawings, and in accordance with the manufacturer's written instructions.

C. Finish Painting: Finish painting of metal surfaces indicated and/or noted to be field painted shall be by the Painting Contractor as specified in Section 09 91 13 - Exterior Painting and Finishing.

3.03 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 07 90 00
JOINT PROTECTION

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, and services necessary for Caulking Work indicated on the Drawings and specified herein. Work includes, but is not limited to the following:

1. Preparation of surfaces.

2. Exterior and interior caulking of the following joint types. Exterior caulking shall be done with sealants, and interior caulking shall be with caulking compounds, however, selected interior locations noted on Drawings or specified herein will require sealant in lieu of caulking compound.

a. Between dissimilar materials, including concrete or masonry to metal (aluminum, steel, stainless steel), and steel to aluminum (at non-metallic shims).

b. Between similar materials as detailed, unless specifically excluded.

3. Expansion and control joints.

4. Between thresholds and adjoining materials.

5. Exterior joints where Mechanical and Electrical Work penetrates concrete or masonry.

6. Wherever indicated by the words, “Seal”, “Sealer”, “Sealant”, “Caulk”, or “Caulking” on the Drawings.

7. Acoustical Sealant.

8. Compressible Back-up Material as required.

9. Firestopping Systems.

10. Cleaning and removing excess materials.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications:

1. Cast in Place Concrete - Section 03 30 00.

2. Unit Structural Masonry - Section 04 23 0.

3. Rough Carpentry - Section 06 10 00.

4. Thermal Insulation - Section 07 21 00.

5. Plaster Veneer System - Section 07 24 00.

6. Sheet Metal Work - Section 07 60 00.

7. Fire Safing - Section 07 84 56.

8. Hollow Metal Doors and Frames - Section 08 11 13.

9. Aluminum Framed Entrances and Storefronts - Sections 08 41 13.

10. Gypsum Wallboard - Section 09 29 00.

11. Paints and Coatings - Section 09 90 00.

12. Caulking and Mastic Operations at Roof and Sealing Sheet Metal Flashings - By Roofing Contractor.

1.02 QUALITY ASSURANCE

A. Environmental Requirements: Paint products such as touch-up field painting and isolation coatings shall comply with all applicable Federal and State Regulations on Volatile Organic Compounds (VOC). PAINT

1.03 SUBMITTALS

A. General: Submit Product Data and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner’s Representative and the General Contractor for review.

C. Product Data: Submit manufacturer’s specification and recommendations for each type of sealant, caulking compound, expansion joint cover, and miscellaneous material required.

D. Sealant Compatibility and Test Reports: Provide reports from sealant manufacturer certifying that materials forming joint substrates of system have been tested for compatibility and adhesion with joint sealants; include sealant manufacturer’s interpretation of results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

E. Samples: Submit Samples of sealants and caulking for review and approval by the Architect. Do not commence Work until the Architect's written approval of the Samples has been received.

1. General: Submit two (2) 12" long Samples of each color and type of exposed-to-view sealant and caulk. Install Sample in 1/2" wide joints between two (2) strips of material representative of exposed surfaces adjacent to joint sealants. Manufacturer's color charts and/or color swatches will not be accepted as Samples.

2. Expansion Joint Covers: Provide samples of sealant system in colors as required to match with adjacent finished surfaces.

1.04 PRODUCT DELIVERY AND STORAGE

A. Delivery: Ship material to job site in plainly marked, original containers, with seals unbroken. Do not ship opened or partially full containers to the site. Materials will be subject to inspection, and rejection at any time. Unload materials at locations designated by the General Contractor.

B. Storage: All materials shall be stored in sheltered enclosures with ambient temperature range of 60 to 80 degree F° at the site until ready for use.

C. Material Shelf Life: Do not retain material at the jobsite which has exceeded the shelf life recommended by the manufacturer.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.05 PROJECT CONDITIONS

A. Temperature and Temporary Enclosures: Do not install compounds when ambient air temperature is less than 40°F. or when recesses are wet or damp. Temporary enclosures and temporary heat may be provided to maintain temperature requirements.

B. Protection: Adjacent finished surfaces shall be protected from damage, by masking or other approved methods, prior to sealing. Remove protection when no longer needed, clean adjacent surfaces smeared by compounds.

1.06 SCAFFOLDING

A. Furnish, erect, and maintain all scaffolding and tarpaulin enclosures, complying with governing code requirements. Erect apparatus at times and locations so as not to delay any part of Work. When Work
has been completed, promptly dismantle all scaffoldings and remove from site.

1.07 WARRANTY

A. General Requirements: The warranty shall state that the Contractor will make good at his expense, all imperfections which may develop in Caulking and Sealing Work during the warranty period, as well as damage to other Work caused by imperfections or by repairing imperfections.

B. Sealant Work: Execute a warranty in the approved written form, warranting all Sealant Work to remain in a serviceable, watertight, elastic, adhesive and perfect condition for a period of not less than three (3) years from date of Owner’s acceptance of the installation.

C. Caulking Work: Execute a warranty in the approved written form, warranting all Caulking Work to remain in a serviceable, watertight, elastic, adhesive and perfect condition for a period of not less than two (2) years from date of Owner’s acceptance of the installation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. Colors: Sealants and caulking compounds shall be of colors as selected and/or reviewed by the Architect to match adjacent finish surfaces.
2. Grade and Consistency: Sealants and caulking compounds shall be of correct grade and consistency for application, to flow easily from application gun, and to tool without excessive tackiness.

3. Material Properties: Set sealants and caulking compounds shall be waterproof, elastic, non-staining and non-corrosive; firm but not brittle hard; remain plastic without cracking at low temperatures; non-sagging at temperatures up to 120°F for 24 hours.

4. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

5. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

   a. Architectural Sealants: Not more than 250 g/L.

   b. Sealant Primers for Nonporous Substrates: Not more than 250 g/L.

   c. Sealant Primers for Porous Substrates: Not more than 775 g/L.

B. Sealants:

1. Sealants - General: Multiple-component polyurethane sealant, non-sag type, conforming to ASTM C920 - Standard Specification for Elastomeric Joint Sealants, Type M, Grade NS, and Federal Specification TT-S-00227E, Type II, Class A, by one of the following manufacturers:

   a. Manufacturer: BASF Construction Chemicals, LLC - Building Systems, 889 Valley Park Drive, Shakopee, MN 55379, (800)243-6739 or (800)433-9517; www.BuildingSystems.BASF.com.

      1) Product: Sonneborn® "Sonolastic® NP 2Ô.

   b. Manufacturer: Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438, (800)523-6688 or (215)723-6051; www.pecora.com.

      1) Product: Dynatrol® II.

   c. Manufacturer: Tremco, Incorporated, Commercial Sealants & Waterproofing Division, 3735 Green Road, Beachwood, OH 44122, (800)321-7906 or (216)292-5000; www.tremcosealants.com.

      1) Products: Dymeric 240 or Dymeric® 240FC.

2. Sealant for Exterior Plaster Veneer System: Product shall be acceptable to Plaster Veneer System Manufacturer. Sealant shall conform to ASTM Standard C920, Grade NS, Class 50, by one of the following manufacturers:

   b. Manufacturer: Dow Corning Corporation, South Saginaw Road, Midland, MI 48686, (800)662-0661 or (989)496-6000; www.dowcorning.com.

1) Product: Dow Corning® 790 Silicone Building Sealant, one-component silicone sealant.

c. Manufacturer: Tremco, Incorporated, Commercial Sealants & Waterproofing Division, 3735 Green Road, Beachwood, OH 44122, (800)321-7906 or (216)292-5000; www.tremcosealants.com.

1) Products: Spectrem® 1 or Spectrem® 3 one-component silicone sealant, “Spectrem® 4-TS” multiple-component silicone sealant or “Dymeric® 240FC” multiple-component polyurethane sealant.

3. Sealant for Traffic Areas: One-component polyurethane sealant, non-sag type, for use in traffic areas, per ASTM Standard C920, by one of the following manufacturers:

a. Manufacturer: BASF Construction Chemicals, LLC - Building Systems, 889 Valley Park Drive, Shakopee, MN 55379, (800)243-6739 or (800)433-9517; www.BuildingSystems.BASF.com.

1) Product: Sonneborn® Sonolastic® NP 1Ô.

b. Manufacturer: Tremco, Incorporated, Commercial Sealants & Waterproofing Division, 3735 Green Road, Beachwood, OH 44122, (800)321-7906 or (216)292-5000; www.tremcosealants.com.

1) Products: Dymonic® FC or Vulkem® 45 SSL.

c. Manufacturer: LymTal International, Inc., 4150 S. Lapeer Road, Lake Orion, MI 48359, (248)373-8100; www.lymtal.com.

1) Product: Iso-Flex® 830, Joint Sealant.

4. Acoustical Sealant: Equivalent to SHEETROCK® Brand Acoustical Sealant as manufactured by United States Gypsum Company, A Subsidiary of USG Corporation, 550 West Adams Street, Chicago, IL 60661, (800)874-4968; www.usg.com.

a. Product Requirements: Acoustical sealant shall be an acrylic, latex-based caulk for use as a joint sealant for sealing sound-rated systems. Sealant shall be non-staining and paintable. Sealant shall meet ASTM Standard C834 and tested in accordance with ASTM Standard E90.

b. Surface Burning Characteristics: Classified by UL, and tested in accordance with ASTM Standard E84:

1) Flame Spread: 0.

2) Smoke Developed: 0.

c. VOC Content: Less than 15 grams/liter.

C. Caulking Compounds:

1. Caulking Compounds - General: One-part, acrylic latex sealant, non-sag type, conforming to ASTM C834 - Standard Specification for Latex Sealants, by one of the following manufacturers:

a. Manufacturer: Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438, (800)523-6688 or (215)723-6051; www.pecora.com.

1) Product: AC-20® + Silicone.

b. Manufacturer: Tremco, Incorporated, Commercial Sealants & Waterproofing Division, 3735 Green Road, Beachwood, OH 44122, (800)321-7906 or (216)292-5000; www.tremcosealants.com.

1) Product: Tremflex® 834.

D. Primers: Provide primer products recommended by the sealant or caulking compound manufacturer, to provide adhesion of the sealant and caulking compounds to, and to prevent staining of adjacent surfaces.

E. Back-up Material:

1. Manufacturer: Construction Foam Products, a Division of Nomaco, Inc., 501 NMC Drive, Zebulon, NC 27597, (800)345-7279 or (919)380-6640; www.cfoamproducts.com.
2. Product: Round, Foam Rod, cylindrical, flexible, extruded, compressible closed cell, polyethylene foam backer rod, Type C - per ASTM Standard C1330, such as Closed-Cell Backer Rod “HBR®”. Provide backer rods in diameters 1/2 larger than width of joints in which rods are installed.

2.02 FIRESTOPPING SYSTEMS:

A. Construction Penetrations: UL Listed firestopping system for through-penetrations shall meet the requirements of ASTM Standard E814 (UL 1479) and provide a fire rating equal to that of construction being penetrated. Backing material and sealant shall not contain asbestos, halogens, and volatile solvents, and shall be flexible to allow for normal

movement of building and penetrating items without adversely affecting the integrity of the system.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: Not more than 250 g/L.

2. Sealant Primers for Nonporous Substrates: Not more than 250 g/L.

3. Sealant Primers for Porous Substrates: Not more than 775 g/L.

C. Firestopping Systems: Provide system/products by one of the following manufacturers:

1. Manufacturer: Hilti, Inc., 5400 South 122nd. East Avenue, Tulsa, OK 74146, (800)879-8000 or (918)252-6000; www.us.hilti.com.

a. System/Products: Hilti Firestop Systems.

2. Manufacturer: Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438, (800)523-6688 or (215)723-6051; www.pecora.com.

a. System/Products: Firestop Systems-UL® Classified.

3. Manufacturer: RectorSeal® Corporation, 2601 Spenwick Drive, Houston, TX 77055, (800)231-3345 or (713)263-8001; www.rectorseal.com.

a. System/Products: Metacaulk® Firestop Materials.

4. Manufacturer: Tremco, Incorporated, Commercial Sealants & Waterproofing Division, 3735 Green Road, Beachwood, OH 44122, (800)321-7906 or (216)292-5000; www.tremcosealants.com.

a. System/Products: TREMstop® Fire Protection Products and related products.

D. Comparable Systems/Products: Comparable equivalent products of other manufacturers may be acceptable, subject to conformance with these Specifications and the Architect's review.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 INSPECTION

A. Inspect all joints to be caulked. Notify the General Contractor in writing (copy to the Architect), of any condition that will prevent the required performances of the compounds, for correction. Installation of the compounds will be considered Contractor's acceptance of the joints. Promptly repair or replace all Caulking and Sealing Work that becomes damaged or defective because of defects in the joint surfaces,
to the satisfaction of the Architect, and at no cost to the Owner.

3.03 PREPARATION

A. Joints to be caulked will be raked out or left open 3/8" to 1/2" deep, maximum by others. Joint width to be 1/2" maximum, 3/8" width for control joints.

B. Clean recesses to receive compound so as be free of dirt, dust, loose material, oil, grease, and all other substances detrimental to the material's performance. Remove lacquer or other protective coatings from metal surfaces, without damage to the surface, prior to sealing. Recesses shall be dry when compounds are installed.

C. If sealing or caulking compounds cause stains on, or do not adhere to, adjacent materials, or if recommended by compound manufacturer, prime all surfaces with specified primer in accordance with compound manufacturer's recommendations.

D. Width or depth of the joint shall be not less than 1/4". In joints up to 1/2" wide, the depth of the sealant shall be equal to the width. In joints wider than 1/2", but not exceeding 1", the depth shall be maintained at 1/2". Joints wider than 1" shall maintain a width to depth ratio of 2 to 1. Fill recesses with backer rod, held back the specified depth from the surface, where joint depths exceed the specified maximums.

E. If joints to receive sealant are filled with other than backer rod specified material, adhere a strip of polyethylene film over the exposed edge of the material, to break the bond of the sealant.

F. Use materials as manufactured, without additives or adulterations. Mix two (or three) component materials until thoroughly and uniformly blended, and then install such materials prior to start of hardening or curing of the materials.

3.04 INSTALLATION OF SEALANTS AND CAULKING COMPOUNDS - GENERAL

A. Sealants and caulking compounds for use in any one area shall be of one brand throughout, mixing of brands on a single wall or in a single room or area is prohibited.

B. All Work shall be done by experienced workmen, in accordance with manufacturer's recommendations, and as specified herein.

C. Install all sealing and caulking compounds immediately after the adjoining Work of other trades is in proper condition to receive same, but before Work has been given applied finishes such as painting or staining, and in a manner to prevent damage occurring by reason of any delay in providing the Work specified herein. No sealing or caulking shall be done until the General Contractor has inspected and approved the preparatory Work and the condition of the adjoining Work.

D. Fill joints completely with sealant and/or caulking compound, without extra cost to the Owner, regardless of variance in joint widths.

E. Install sealants and caulking compounds under pressure, without smearing adjacent surfaces. Compounds shall have full and uniform contact and adhesion with sides of joint recesses.

F. Finish sealants and caulking compounds in recesses, in angular surfaces, with a smooth surface, flush with face of material at each side. Finish sealants and caulking compounds, in recesses, between masonry and jambs, with a smooth surface, flush with the face of the metal frame on one side and with face of masonry on the other side. Finish sealants and caulking compounds in recesses, in flush surfaces (including masonry walls), with a smooth concave surface, flush with face of material at each side.

G. Surfaces of sealants and caulking compounds in joints shall be smooth and even, free from dirt, stain or other defacements, and be uniform in color throughout.

H. Tooling of joints will be allowed, provided that such operations do not damage the seal or tear the compounds.

3.05 INSTALLATION OF SEALING COMPOUNDS

A. Building Exterior: Fill with sealant, as required to provide a weathertight condition, all exposed joints that are not subject to movement but require finishing, and all joints that are not subject to excessive movement. Principal locations shall include, but not be limited to, the following:

1. Joints between Dissimilar Materials: All exposed joints in the exterior walls, between dissimilar materials, including masonry or concrete construction to metal

(aluminum, steel, stainless steel) such as door frames, frames for glass and other miscellaneous openings; and steel to aluminum (at non-metallic shims).

2. Joints between Similar Materials: All joints between similar materials such as masonry control joints, etc., unless specifically excluded.

3. Noted Locations: Wherever indicated by the words “seal” or “sealant” on the Drawings.

4. Exterior Plaster Veneer: Joint filler, primer, and bond breaker shall be in accordance with the sealant manufacturer’s specifications and instructions. Application of the sealant shall be as recommended by the plaster veneer system manufacturer, subject to review by the Architect.

    a. Back-up Material: Sealant backer rods, as required by field conditions shall be of closed cell.

    b. Textured Finishes or Base Coat Surfaces: Sealant shall not be applied directly to textured finishes or base coat surfaces. Plaster veneer system base coat surfaces subject to be in contact with sealant shall be coated with acrylic coating or pigmented acrylic primer. Coordinate Work with Plaster Veneer System Contractor.

B. Building Interior: Fill with sealant, as required to provide a closed condition, all exposed joints that are subject to movement, but not excessive movement, or where specifically noted on Drawings. Principal locations shall include, but not be limited to the following:

1. Joints Between Dissimilar Materials: All exposed joints in exterior and interior walls, between dissimilar materials generally, including masonry or concrete to metal (aluminum, steel, stainless steel), such as door frames, frames for glass and other openings, and steel to aluminum (at non-metallic shims).

2. Joints Between Similar Materials: All exposed joints between similar materials such as masonry control joints, unless specifically excluded.

C. Acoustical Sealant: Comply with sealant manufacturer’s written directions and instructions for preparation and application of sealant.

1. Coordinate with Gypsum Wallboard Contractor for installation of coustical sealant at sound-rated partitions where indicated on the Drawings; applied in accordance with ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications, using conventional caulking equipment.

2. At partition walls, provide continuous beads of acoustic sealant at juncture of both faces of runners with floor and ceiling construction, and wherever gypsum board abuts dissimilar materials, prior to installation of gypsum board.

3. At ceilings, provide continuous beads of sealant wherever gypsum board abuts dissimilar materials.

4. Provide continuous bead of sealant behind faces of control joints prior to installation of control joint accessories.

5. After installation of gypsum board base layer(s), fill open space between gypsum board and floor, ceiling and dissimilar vertical construction with continuous sealant beads after installation of face layer.

6. At openings and cutouts, fill open spaces between gypsum board and fixtures, cabinets, ducts and other flush or penetrating items, with continuous bead of sealant.

7. Seal sides and backs of electrical boxes to completely close off openings and joints.

8. Sound Flanking Paths:

   a. Where sound-rated partition walls intersect non-rated gypsum board partition walls, provide acoustical sealant at extended sound-rated construction to completely close sound flanking paths through non-rated construction.

   b. Seal joints between face layers at vertical interior angles of intersecting partitions.

3.06 INSTALLATION OF CAULKING COMPOUNDS

A. Building Interior: At interior of building, fill with caulking compound, all exposed joints not subject to movement that require a finished appearance. Principal locations shall include, but not be limited to the following:

1. Joints in interior walls, between masonry and metal frames.

2. Joints in interior walls, between masonry and adjacent construction.

3. Wherever indicated by the words “caulk” or “caulking” on the Drawings, except if the locations are specified to be sealed.

3.07 INSTALLATION OF FIRESTOPPING SYSTEM

A. Prepare substrate surfaces to insure proper support for firestop system. Clean surfaces of all foreign material including loose debris, dirt, oil, grease, and wax. Install firestop material in accordance with manufacturer’s printed instructions and UL requirements.

3.08 CLEANING

A. Excess Sealing and Caulking Materials: Remove excess sealing and caulking materials from adjacent surfaces before materials have set up. Follow manufacturer's instructions for removal of sealing and caulking materials from finished surfaces. Repair surfaces damaged by sealing and caulking operations. Obtain written approval, from the Architect, of the entire installation after completion.

B. Debris and Waste Materials: During progress of the Work, keep the premises free of debris and waste materials resulting from Sealing and Caulking Work. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish from the site, and dispose of legally. Upon completion and before final acceptance of the Work, remove unused materials, tools, and equipment from the site.

C. Waste Management: Collect field generated construction waste created during construction or final.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard hollow metal doors and frames.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section “Wood Doors” for wood doors in hollow metal frames.
3. Division 08 Section "Door Hardware (Scheduled by Describing Products)" for door hardware for hollow metal doors and frames.
4. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
5. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of electrical knockout boxes and preparations for power, signal, and control systems.

C. Samples for Verification:

1. Samples are only required by request of the architect and for manufactures that are not current members of Steel Door Institute.
2. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
3. For the following items, prepared on Samples about 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:

   a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
   b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Comply with NFPA 105.

E. Preinstallation Conference: Conduct conference at Project site for hollow metal frames requiring electrical knockout boxes to verify installation of conduit on frames.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with this section requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Steelcraft; an Ingersoll-Rand company.
5. No Substitution; only material from an SDI member will be allowed on the jobsite unless prior approval is given in accordance with substitution request requirements per General Requirements section.

2.2 MATERIALS

A. Cold-Rolled Steel Sheets: Carbon steel complying with ASTM A 366 (ASTM A 366M), commercial quality, or ASTM A 620 (ASTM A 620M), drawing quality, special killed.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) 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.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Glazing: Comply with requirements in Division 08 Section "Glazing."

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide 1 3/4" thick beveled and handed doors of design indicated, fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Flush panel
2. Core Construction: Manufacturer's standard polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
    b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-rated assemblies with R Factor 11 or better.

        1) Locations: Exterior doors.

3. Vertical Edges for Single-Acting Doors: Beveled edge

    a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).

4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheets. 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), minimum 16 gauge (0.053-inch - 1.3-mm-) thick steel, Model 2 (Seamless face and edges).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. 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), minimum 16 gauge (0.053-inch - 1.3-mm-) thick steel, Model 2 (Seamless face and edges).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheets.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as face welded joints and back weld joints continuously, unless otherwise indicated.
3. Frames for Level 3 Steel Doors: minimum 14 gauge 0.067-inch- (1.7-mm-) thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as face welded unless otherwise indicated.
3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
4. Frames for Level 3 Steel Doors: minimum 16 gauge 0.053-inch- (1.3-mm-) thick steel sheet.
5. Frames 48-inches and wider in opening width are required to be minimum 14 gauge 0.067-inch- (1.7-mm-) thick steel sheet.
6. Frames for Wood Doors: minimum 16 gauge 0.053-inch- (1.3-mm-) thick steel sheet.
7. Frames for Borrowed Lights: minimum 16 gauge 0.053-inch- (1.3-mm-) thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engauge stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches (0.4 mm) thick.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8

C. Hollow Metal Doors:

1. Exterior Doors:

   a. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Top of door to be flush and completely sealed joints in top edges of doors against water penetration.

2. Glazed Lites: Factory cut openings in doors with applied flush trim to fit.
3. Astragals: Provide overlapping astragal as noted in door hardware sets in Division 8 Door Hardware on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
4. Electrical Raceways: Provide raceways for standardized plug connectors to accommodate up to twelve (12) wires as required for electrified door hardware specified in hardware sets in Division 8 Door Hardware. Provide sufficient number of concealed

wires to accommodate electric function of specified hardware. Wire nut connections are not acceptable.

5. Seamless Edge: Provide seamless edge on hollow metal doors by intermittently tack welding seam, grinding smooth and finishing edge free from defects and blemishes.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Continuously backweld joints at exterior frames.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops required wider dimension on glass side of frame.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 42-inch and wider with mortise/butt type hinges only at top hinge location to deter against hinge reinforcement sag.
5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops; provide security head screws at exterior locations.
6. Grout Guards: Weld guard boxes to frame at back of mortise hardware prep in frames at all hinge, strike and other recessed hardware preps regardless of grouting requirements.
7. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; included but not limited to electric thru wire hinges, electrical raceways, door position switches, electric strikes, jamb mount card readers, and magnetic locks as noted in door hardware sets in Division 8 Door Hardware.

    a. Electrical knock out boxes are required at door position switches, electric strikes, card readers, and middle hinge locations for all exterior locations regardless of electrical hardware specified in Division 8 Door Hardware.
    b. Provide electrical knock out boxes with 3/4-inch knockouts.
    c. Conduit to be coordinated and installed in field from middle hinge box and strike box to door position box.
    d. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 8 Door Hardware.
    e. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
    f. Provide field installed conduit per Division 28 section for standardized plug connectors to accommodate up to twelve (12) wires as required for electrified door hardware specified in hardware sets in Division 8 Door Hardware. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Wire nut connections are not acceptable.

8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

1) Two anchors per jamb up to 60 inches (1524 mm) high.
2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

1) Three anchors per jamb up to 60 inches (1524 mm) high.
2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
5) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.

10. Door Silencers: Except on weather-stripped or gasketed doors, drill stops to receive door silencers as follows. Keep holes clear during construction. Silencers to be supplied by frame manufacture regardless if specified in division 8 Door Hardware.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive 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 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricators shop

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 glazed lites are capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

4. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.
5. Gap for butted or mitered joints in glass stop should not exceed .0625-inch.

2.9 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

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 grouting.
    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.
    g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post installed expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of post installed expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. Field Supplied 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.
7. Grouting Requirements:

    a. Do not grout head of frames unless reinforcing has been installed in head of frame.
    b. Do not grout vertical or horizontal closed mullion members.

8. 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 (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in 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 (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

    a. Secure exterior removable stops with security head screws.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Service doors

B. Related Sections:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

2. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for finish painting of factory-primed doors.

3. Section 111200 "Parking Control Equipment" for parking control equipment interlocked to overhead coiling doors.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.

1. Wind Loads: As indicated on structural drawings and to comply with the 2006 IBC code.

a. Basic Wind Speed: 110 mph (49 m/s)

b. Exposure Category: C.

2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

C. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa) wind load, acting inward and outward.

D. Windborne-Debris-Impact-Resistance Performance: Provide impact-protective overhead coiling doors that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and ASTM E 1996.

1. Large Missile Test: For overhead coiling doors located within 30 feet (9.144 m) of grade.

2. Small Missile Test: For overhead coiling doors located more than 30 feet (9.144 m) above grade.

E. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified

2. Retain subparagraph below for projects requiring seismic design. The Component Importance Factor is 1.5 for life safety components required to function after an earthquake. For other components, the Component Importance Factor is 1.0 unless the structure is in Seismic Use Group III and the component is necessary for continued operation of the facility or if failure of the component could impair continued operation of the facility, in which case it is 1.5.

F. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.4 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:

1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Show locations of replaceable fusible links.

3. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.

2. Summary of forces and loads on walls and jambs.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Seismic Qualification Certificates: For overhead coiling doors**,** accessories, and components, from manufacturer.

C. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

PART 2 PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch and as required to meet requirements.

2. Stainless-Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 0.025 inch and as required to meet requirements.

3. Aluminum Door Curtain Slats: ASTM B 209 (ASTM B 209M) sheet or ASTM B 221 (ASTM B 221M) extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch and as required to meet requirements.

4. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet or fire-protection rated glass as required for type of door; set in glazing channel secured to curtain slats.

5. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.

6. Plastic Interior Curtain-Slat Facing: Extruded PVC plastic with maximum flame-spread index of 75 and smoke-developed index of 450, according to ASTM E 84.

7. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.

B. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

C. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain**,** and a continuous bar for holding windlocks.

1. Removable Posts and Jamb Guides for Counter Doors: Manufacturer's standard.

2.2 HOOD

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.

2. Stainless Steel: 0.025-inch thick stainless-steel sheet, Type 304, complying with ASTM A 666.

3. Aluminum: 0.040-inch thick aluminum sheet complying with ASTM B 209 (ASTM B 209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.

4. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.3 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: Provide cylinders specified in Section 087100 "Door Hardware" and standard with manufacturer and keyed to building keying system.

2. Keys: Provide two for each cylinder.

C. Chain Lock Keeper: Suitable for padlock.

D. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.4 CURTAIN ACCESSORIES

A. Smoke Seals: Equip each fire-rated door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling by a qualified testing agency.

B. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.

1. At door head, use 1/8-inchthick, replaceable, continuous sheet secured to inside of hood.

2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch thick seals of flexible vinyl, rubber, or neoprene.

C. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

1. Provide pull-down straps or pole hooks for doors more than 84 inches high.

2.5 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.7 MANUAL DOOR OPERATORS

A. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.

B. Push-up Door Operation: Design counterbalance mechanism so required lift or pull for door operation does not exceed 25 lbf (111 N).

C. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 30 lbf (133 N) force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

D. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 30 lbf (133 N) force to turn crank. Fabricate gearbox to be oil tight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

1. Reversible motor and controller (disconnect switch) for motor exposure indicated.

2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec. without exceeding nameplate ratings or service factor.

3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.

4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

2.8 DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. ACME Rolling Doors.

b. C.H.I. Overhead Doors.
c. City-Gates.

d. Cookson Company.

e. Cornell Iron Works, Inc.

f. McKeon Rolling Steel Door Company, Inc.

g. Raynor.

h. Southwestern Steel Rolling Door Co.

B. Door Curtain Material: Coated – Pre-finished Galvanized steel.

C. Door Curtain Slats: Round profile slats of 1-1/2-inch center-to-center height.

1. Insulated-Slat Interior Facing: Metal.

D. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

E. Hood: Match curtain material and finish.

1. Shape: Square

2. Mounting: As shown on Drawings.

F. Integral Frame, Hood, and Fascia for Counter Door: Galvanized steel.

1. Mounting: As shown on Drawings.

G. Sill Configuration for Counter Door: No sill.

H. Locking Devices: Equip door with slide bolt for padlock.

I. Manual Door Operator: Chain-hoist operator.

1. Provide operator with through-wall shaft operation.

2. Provide operator with manufacturer's standard removable operating arm.

J. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color selected by Architect/Owner.

2. Factory Prime Finish: Submit Manufacturer's standard colors for review.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 STEEL AND GALVANIZED-STEEL FINISHES

A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

2.11 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.

2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

3. Directional Satin Finish: No. 4.

C. Bright, Cold-Rolled, Unpolished Finish: Color to be selected by Architect/Owner.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Fire-Rated Doors: Install according to NFPA 80.

E. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Perform installation and startup checks according to manufacturer's written instructions.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide weathertight fit around entire perimeter.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

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 the following:

1. Commercial door hardware for the following:

a. Swinging doors.
b. Other doors to the extent indicated.

B. Related Sections include the following:

1. Division 8 Section "Steel Doors and Frames" for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the frame.
2. Division 8 Section "Flush Wood Doors" for astragals provided as part of a fire-rated labeled assembly.
3. Division 8 Section "Aluminum Entrances and Storefronts" for entrance door hardware, except cylinders.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1.3 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.

a. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced Installer who has completed both standard and electrified builders hardware and integrated access control installations 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. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant or equivalent experience available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying. Supplier recognized by manufacturers to be a direct factory-authorized distributor of the specified hardware products.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant (AHC) and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

D. Source Limitations: Obtain each type and variety of aluminum, steel and wood door hardware from the same single source manufacturer and supplier, unless otherwise indicated.

E. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:

    a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
    b. Door Closers: Comply with the following maximum opening-force requirements indicated:

        1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
        2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

    c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:

    a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
    b. Thresholds: Not more than 1/2 inch high.

3. International Building Code (2003).

F. Keying Conference: Conduct conference to comply with requirements in Division 1 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 system.
4. Address and requirements for delivery of keys.

1.5 DELIVERY, STORAGE, AND HANDLING

A. One complete shipment of door hardware as detailed in approved Door Hardware Schedule Shop Drawings to be inventoried on site and upon receipt of material, be secured in lock-up room provided with shelving for door hardware.

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 permanent keys, cylinders, and cores directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Door Hardware Supplier to provide and distribute to the parties involved for templating for doors, frames, and other work specified to be factory prepared for installing standard, electrified and access control door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

1.7 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. Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

C. Special Warranty Periods:
1. Five years for bored latches and locksets.
2. Five years for exit devices.
3. Ten years for manual door closers.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and the Door Hardware Schedule at the end of Part 3.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated for named products listed in Hardware Sets.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule 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. (Source manufacturer listed in boldface).

2.2 HINGES AND PIVOTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hinges:

a. Hager Companies (HA).
b. McKinney Products (MC).
c. Stanley Hardware (ST).
d. Ives (IV).

B. Standards: BHMA Certified products complying with the following:

1. Butts and Hinges: BHMA A156.1.

C. Quantity: Provide the following, unless otherwise indicated:

1. Two Hinges: For doors with heights up to 60 inches.
2. Three Hinges: For doors with heights 61 to 90 inches.
3. Four Hinges: For doors with heights 91 to 120 inches.
4. 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.

D. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

Maximum Door Size (inches)	Hinge Height (inches)	Metal Thickness (inches) Standard Weight	Heavy Weight
36-in by 86-in by 1-3/4	4-1/2	0.134	0.180
< 36-in by 120-in by 1-3/4	5	0.146	0.190

E. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

1. Exterior Doors: Heavy weight, non-ferrous, ball bearing hinges.
2. Interior Doors: Heavy weight, ball bearing hinges unless Hardware Sets indicate standard weight.

2.3 DOOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flush Bolts and Coordinators:

a. McKinney Products (MC).
b. Rockwood Manufacturing (RO).
c. Trimco Manufacturing (TR).
d. Ives (IV).

B. Standards: Comply with the following:
1. Manual Flush Bolts: BHMA A156.16.

C. Surface Bolts and Flush Bolts: BHMA Certified Grade 1.

D. Provide bolts with top rod of sufficient length to allow bolt location approximately six feet from the floor regardless if detailed as such in hardware sets. Furnish dust proof strikes for bottom bolts. Surface bolts to be 8” in length, unless otherwise noted and U.L. listed for labeled fire doors.

E. Bolt Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Mortise Flush Bolts: Minimum 3/4-inch throw.

2.4 LOCKS AND LATCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mechanical Bored or Mortise Locks and Latches:
   a. Corbin Russwin Hardware (CR)
   b. Sargent Manufacturing (SA)
   c. Schlage (SC)
   d. Yale Security Group (YA)
   e. Best Access Systems (BE)

2. Mortise Deadbolts:
   a. Adams Rite (AR)

B. Standards: Comply with the following:
1. Bored Locks and Latches: BHMA A156.2.

C. Bored Locks: BHMA Certified Grade 1, Series 4000.

D. Lock Trim: Match the following design style in the hardware sets.

E. Lock Functions: Function numbers and descriptions indicated in the Door Hardware Schedule comply with the following:
1. Bored Locks: BHMA A156.2.

F. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
1. Bored Locks: Minimum 1/2-inch latchbolt throw.

G. Backset: 2-3/4 inches unless otherwise indicated.

2.5 CYLINDERS AND KEYING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cylinders:
   a. Corbin Russwin Hardware (CR)
   b. Sargent Manufacturing (SA)
   c. Schlage (SC)
   d. Yale Security Group (YA)
   e. Best Access Systems (BE)

B. Standards: Comply with the following:

1. Cylinders: BHMA A156.5.

C. Cylinder Grade: BHMA Certified Grade 1.

D. Construction Keying: Comply with the following:

1. Construction Master keying: Provide temporary construction keyed cylinders that can be easily voided by the owner using the change keys. Provide construction keys in quantity as required by project Contractor.

E. Keying System: Unless otherwise indicated, provide for a keying system complying with the following requirements:

1. New Master Key System: Cylinders are factory keyed operated by a change key, master key, and a grand master key. Conduct keying meeting with End User to define and document keying system instructions and requirements.

F. Keys: Provide nickel-silver keys complying with the following:

1. Stamping: Permanently inscribe each key with a visual key control number and as directed by Owner.
2. Quantity: Provide the following:

a. Cylinder Change Keys (Per Key Set): Three.
b. Master Keys (Per Level): Five.
c. Grand Master Keys: Two.

G. Key Registration List: Provide keying transcript list to Owner's representative for lock cylinders.

H. Key Control System: Provide one lockable cabinet for key control and storage for up to 150 percent capacity, type and model to be determined in the keying meeting with the owner.

2.6 EXIT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Exit Devices:

a. Corbin Russwin Hardware (CR) – ED5000S Series
b. Yale Security Group (YA) – 7150 Series
c. Von Duprin (VO) – 99XP Series

2. Exit Device Trim, Pull:

a. Corbin Russwin Hardware (CR)
b. Yale Security Group (YA)
c. Von Duprin (VO)

B. Standard: BHMA A156.3.

C. Exit Devices: BHMA Certified Grade 1.

D. Latchbolt: High –grade, heat-treated, corrosion-resistant nickel steel alloy. Slide-action deadbolt with positive deadlocking by auxiliary bolt.

E. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

2.7 CLOSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one the following:

1. Surface-Mounted Closers (Heavy Duty): BHMA Certified Grade 1.

    a. Corbin Russwin Hardware (CR) - DC6000 Series with heavy duty arms.
    b. LCN Door Closers (LC) – 4040 Series with heavy duty arms.
    c. Norton Door Controls (NO) - 7500 Series with heavy duty arms.
    d. Sargent Manufacturing (SA) - 351 Series with heavy duty arms.
    e. Yale Security Group (YA) - 4400 Series with heavy duty arms.

2. Surface-Mounted Closers (Standard Duty): BHMA Certified Grade 1.

    a. Corbin Russwin Hardware (CR) - DC3000 Series.
    b. LCN Door Closers (LC) – 1460 Series.
    c. Norton Door Controls (NO) - 8500 Series.
    d. Sargent Manufacturing (SA) - 1331 Series.
    e. Yale Security Group (YA) - 3500 Series.

B. Standards: Comply with the following:

1. Closers: BHMA A156.4.

C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide non-handed, factory-sized closers adjustable to meet field conditions and requirements for opening force.

D. Closer Options: As indicated in hardware sets, provide door closer options including: delayed action, hold open arms, extra duty parallel arms, positive stop/hold open arms, compression stop/hold open arms, special mounting brackets, spacers and drop plates. Through bolt type mounting is required as indicated in the door hardware sets.

2.8 OPERATING and PROTECTIVE TRIM UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Protective Trim Units:

a. McKinney Products (MC).
b. Rockwood Manufacturing (RO).
c. Trimco Manufacturing (TR).
d. Ives (IV).

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate protection plates from the following:

1. Brass/Bronze and Stainless Steel: .050 inches thick, beveled four sides (B4E) with countersunk screw holes.

D. Push-Pull Design: 1" Round with 10" Centers. Provide 90 degree offset pulls at exterior openings.

E. Fasteners: Provide manufacturer's designated fastener type as indicated in door hardware sets.

F. Furnish protection plates sized 1-1/2 inches less than door width (LDW) on push side and 1 inch less door width on pull side by height specified in door hardware sets.

2.9 STOPS AND HOLDERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Stops and Holders:

a. McKinney Products (MC).
b. Rockwood Manufacturing (RO).
c. Trimco Manufacturing (TR).
d. Ives (IV).

B. Standards: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.
2. Door Silencers: BHMA A156.16.

C. Stops and Bumpers: BHMA Certified Grade 1.

D. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch fabricated for drilled-in application to frame. Provide (3) per single door and (2) per paired door frame if applied gasketing is not specified in Hardware Sets.

2.10 FINISHES

A. Standard: Comply with BHMA A156.18.

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.

D. BHMA Designations: Comply with base material and finish requirements indicated by the following:
1. BHMA 626: Satin chromium plated over nickel, over brass or bronze base metal.
2. BHMA 628: Satin aluminum, clear anodized, over aluminum base metal.
3. BHMA 630: Satin stainless steel, over stainless-steel base metal.
4. BHMA 652: Satin chromium plated over nickel, over steel base metal.
5. BHMA 689: Aluminum painted, over any base metal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical source power to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. 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. Steel Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."

3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

C. Provide and coordinate concealed wood blocking for wall mount stops as detailed in Door Hardware Schedule.

3.4 FIELD QUALITY CONTROL

A. The Contractor shall comply with AIA A201 1997 section 3.3.1 which reads as follows: “The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the contract Documents give other specific instructions concerning these matters.”

B. 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.

1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DOOR HARDWARE SETS

A. The hardware sets listed below 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.

SET #1 - Exterior Egress Door

Doors: 111,102E, 102K

3 Hvy Wgt Hinges SS NRP	T4A3386 4 1/2 X 4 1/2 NRP	32D	MC
1 Rim Exit Device - SB	7150	630	YA
1 Exit Device Trim - Pull x Cyl	632F	626	YA
1 Rim Cylinder	1109	626	YA
1 PA Closer - HD Arm	PR4400 TBGN	689	YA
1 Kickplate	KP50 10" x 2" LDW B4E CSK	US32D	MC
1 Heavy Duty Door Stop	DS08	US32D	MC
1 Set Weatherstrip	MCK303 AV (Head and Jambs)		MW
1 Raindrip	MCK346 C x Length Required		MW
1 Door Sweep with Drip	MCK345 AV x Length Required		MW
1 Panic Threshold MCK2005 AV x Length Required			MW

SET #2 - Storage

Doors: 108, 107

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	PB 5405LN	626	YA
1 Surface Closer	4400	689	YA
1 Door Stop	409 / 446	US32D	RO
1 Gasketing	S773D		PE

SET #3 - Overhead Door

Doors: 102A, 102B 102C, 102D, 102F, 102G, 102H, 102J

1 Cylinder	As required	626	YA

SET #4 - Office Door with Wall Stop

Doors: 110

3 BB Hinges	TA2714 4 1/2 X 4 1/2	26D	MC
1 Entrance/Office Lock	PB 5407LN	626	YA
1 Concave Wall Stop	WS04	US26D	MC
3 Door Silencers	S1M		MC

SET #5 - Toilet with Wall Stop

Doors: 105, 106

3	PB Hinges	T2714 4 1/2 X 4 1/2	26D	MC
1	Privacy Set	PB 5402LN	626	YA
1	Mop Plate	KP50 4" x 1" LDW B4E CSK	US32D	MC
1	Concave Wall Stop	WS04	US26D	MC
1	Smoke Seal	MCKS88 C (Head and Jambs)		MW
1	Reg/PA Closer - HO	3511 TBGN	689	YA

SET #6 - Passage

Doors: 109, 104

3	BB Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Passage Set	AU 5401LN	626	YA
1	Concealed Overhead Stop	2-X36	689	RF
1	Surface Closer	3501	689	YA
1	Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1	Gasketing	S88D (Head and Jambs)		PE

END OF SECTION

SECTION 09 24 00
CEMENT PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Exterior portland cement plasterwork (stucco) on paper backed metal lath over unit masonry.

B. Related Sections:

   1. Section 054000 "Cold-Formed Metal Framing" for structural, load-bearing (transverse and axial) steel studs and joists that support lath and portland cement plaster.
   2. Section 061000 "Rough Carpentry" for wood framing and furring included in portland cement plaster assemblies.
   3. Section 061600 "Sheathing" for sheathing and water-resistant barriers included in portland cement plaster assemblies.
   4. Section 072100 "Thermal Insulation" for thermal insulations and vapor retarders included in portland cement plaster assemblies.
   5. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support lath and portland cement plaster.
   6. Section 092300 "Gypsum Plastering" for gypsum-based conventional plaster and associated lath.
   7. Section 092613 "Gypsum Veneer Plastering" for gypsum-based veneer plaster applied on gypsum base for veneer plaster, unit masonry, and monolithic concrete.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

C. Samples for Initial Selection: For each type of factory-prepared finish coat indicated.

D. Samples for Verification: For each type of textured finish coat indicated; 12 by 12 inches (305 by 305 mm), and prepared on rigid backing.

1.4 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by, and displaying a classification label from, a qualified independent testing agency acceptable to the authority having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Construct fire-resistance rated partitions in compliance with tested assembly requirements where indicated on drawings.
2. Rated assemblies to be substantiated from applicable testing using proposed products, by Contractor.
3. Both metal framing and wallboard manufacturers must submit written confirmation that they accept the other manufacturer's product as a suitable component in the assembly. Acceptance is as follows:

    a. If installation of both products is proper, no adverse effect will result in the performance of one manufacturer's product by the other's product.
    b. Combining products can be substantiated by required assembly tests.

4. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

B. Sound-Transmission Characteristics: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.

C. Mockups: Before plastering, install mockups of at least 100 sq. ft. (9.3 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for each type of finish indicated.
2. For interior plasterwork, simulate finished lighting conditions for review of mockups.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

B. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".

1.6 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Interior Plasterwork: Maintain room temperatures at greater than 40 deg F (4.4 deg C) for at least 48 hours before plaster application, and continuously during and after application.

1. Avoid conditions that result in plaster drying out during curing period. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
2. Ventilate building spaces as required to remove water in excess of that required for hydrating plaster in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

C. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

D. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 METAL LATH

A. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet, ASTM A 653/A 653M, G60 (Z180). Equal to: Clark Dietrich paper backed galvanized metal lath.

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by ClarkDietrich Building Systems or comparable product by one of the following:

   a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
   b. CEMCO.
   c. MarinoWARE.
   d. Phillips Manufacturing Co.

2. Diamond-Mesh Lath: Flat, Self-furring, 3.4 lb/sq. yd. (1.8 kg/sq. m)].

3. V Truss Corners - Exterior Corner Reinforcements:

   a. Profile: Straight.
   b. Finish: Class 1 Galvanized Coating complying with ASTM A 641.
   c. As per ICC ESR-2017.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Davis Wire Corporation; a Heico Wire Group company.
   b. Jaenson Wire Company.
   c. Keystone Steel & Wire Co.
   d. K-Lath; a division of Georgetown Wire.
   e. Architect approved equal.

B. Paper Backing: FS UU-B-790, Type I, Grade D, Style 2 vapor-permeable paper.

1. Provide paper-backed lath unless otherwise indicated at all exterior locations.

2.2 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by ClarkDietrich Building Systems or comparable product by one of the following:

    a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
    b. CEMCO.
    c. MarinoWARE.
    d. Phillips Manufacturing Co.
    e. Architec approved equal.

2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
3. Cornerite: Fabricated from expanded metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
4. Strip Lath: Fabricated from expanded-metal lath with ASTM A653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
5. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
6. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.

    a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
    b. Small nose cornerbead with perforated flanges; use on curved corners.
    c. Small nose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing masonry corners.

7. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
8. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
9. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
10. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6.34 to 16 mm) wide; with perforated flanges.

C. Accessories for Portland Cement Base Plaster: ASTM C 1063. Fabricated from Zinc Alloy (99 percent pure zinc), galvanized (zinc coated) steel, rigid PVC or CPVC plastic, or anodized aluminum alloy.

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by ClarkDietrich Building Systems or comparable products by one of the following:

    a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
    b. Phillips Manufacturing Co.
    c. Plastic Components, Inc.
    d. Vinyl Corp.
    e. TXI Model Lone Star Stucco

2. Corner beads: With perforated flanges.

    a. Small nose corner bead; use unless otherwise indicated.

3. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.

    a. Square-edge style; use unless otherwise indicated.

4. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
5. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged 1-inch-(25-mm-) wide reveal; with perforated concealed flanges.
6. Soffit Reveals: PVC reveals conforming to ASTM C 1047.

    a. Vinyl Corp. "No. DC58-50SE".

7. Soffit Vents: Vinyl soffit vent.

    a. Vinyl Corp. "No. CSJ50-200V".

D. Plastic Accessories for Gypsum Wallboard and Gypsum Veneer Base: ASTM C847. Fabricated from plastic or plastic and paper in combination shall be manufactured from rigid PVC, ABS, PETG, high-impact polystyrene (HIPS), or polycarbonate (PC) plastic not less than 0.028 inch (0.7112 mm) and Section 4.3.1 PVC specification D 3678 Class II.

1. Basis-of Design Product: Subject to compliance with requirements, provide products by ClarkDietrich Building Systems or comparable products by one of the following:

    a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
    b. Plastic Components, Inc.
    c. Vinyl Corp.
    d. Architect approved equal

2.3 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.

C. Bonding Compound: ASTM C 932.

D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.

E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.

F. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.

2.4 PLASTER MATERIALS

A. Portland Cement: ASTM C 150,Type II.

1. Color for Finish Coats: To be determined.

B. Masonry Cement: ASTM C 91, Type N.

1. Color for Finish Coats: To be determined.

C. Plastic Cement: ASTM C 1328.

D. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

E. Sand Aggregate: ASTM C 897.

1. Color for Job-Mixed Finish Coats: White note: stucco is to be painted with elastomeric paint.

F. Perlite Aggregate: ASTM C 35.

G. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, and proprietary ingredients.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bonsal American, an Oldcastle Company; Marblesil Stucco Mix.
b. TXI Model- Lone Star Stucco
c. El Rey Stucco Company, Inc., a brand of ParexLaHabra, Inc.; Premium Stucco Finish.
d. Florida Stucco; Florida Stucco.

e. LaHabra, a brand of ParexLaHabra, Inc.; Exterior Stucco Color Coat.
f. Omega Products International, Inc.; ColorTek Exterior Stucco.
g. QUIKCRETE; QUIKCRETE Finish Coat Stucco, No. 1201.

2. Color: with-out color agent as the stucco is to receive coats of elastomeric paint.

2.5 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:

1. Portland Cement Mixes:

a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

2. Masonry Cement Mixes:

a. Scratch Coat: 1 part masonry cement and 2-1/2 to 4 parts aggregate.
b. Brown Coat: 1 part masonry cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.

3. Portland and Masonry Cement Mixes:

a. Scratch Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
b. Brown Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

4. Plastic Cement Mixes:

a. Scratch Coat: 1 part plastic cement and 2-1/2 to 4 parts aggregate.
b. Brown Coat: 1 part plastic cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.

5. Portland and Plastic Cement Mixes:

    a. Scratch Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
    b. Brown Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:

1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 3/4 part lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
2. Portland and Masonry Cement Mix: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
3. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.

D. Base-Coat Mixes: Single base coats for two-coat plasterwork as follows:

1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
2. Masonry Cement Mix: Use 1 part masonry cement and 2-1/2 to 4 parts aggregate.
3. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.

E. Job-Mixed Finish-Coat Mixes:

1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
2. Masonry Cement Mix: 1 part masonry cement and 1-1/2 to 3 parts aggregate.
3. Portland and Masonry Cement Mix: For cementitious materials, mix 1 part portland cement and 1 part masonry cement. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
4. Plastic Cement Mix: 1 part plastic cement and 1-1/2 to 3 parts aggregate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLATION, GENERAL

A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

B. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

C. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

3.4 INSTALLING METAL LATH

A. Expanded-Metal Lath: Install according to ASTM C 1063.

1. Partition Framing and Vertical Furring: Install flat diamond-mesh lath.
2. Flat-Ceiling and Horizontal Framing: Install flat diamond-mesh lath.
3. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh welded-wire lath.

3.5 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for External Corners:

1. Install lath-type, external-corner reinforcement at exterior locations.
2. Install corner bead at interior and exterior locations.

C. Control Joints: Install control joints at locations indicated on Drawings.

1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:

a. Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
b. Horizontal and other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).

2. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
4. Where control joints occur in surface of construction directly behind plaster.

5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.6 PLASTER APPLICATION

A. General: Comply with ASTM C 926.

1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6.4 mm in 3 m) from a true plane in finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Bonding Compound: Apply on unit masonry plaster bases.

C. Walls; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork**,** on masonry; 3/4-inch (19-mm) thickness.

1. Portland cement mixes.
2. Masonry cement mixes.
3. Portland and masonry cement mixes.
4. Plastic cement mixes.
5. Portland and plastic cement mixes.

D. Ceilings; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 3/4 inch (19 mm) .

1. Portland cement mixes.
2. Masonry cement mixes.
3. Portland and masonry cement mixes.
4. Plastic cement mixes.
5. Portland and plastic cement mixes.

E. Walls; Base-Coat Mix: Scratch coat for two-coat plasterwork, 3/8 inch (10 mm) thick on concrete masonry.

1. Portland cement mixes.
2. Masonry cement mixes.
3. Portland and masonry cement mixes.
4. Plastic cement mixes.
5. Portland and plastic cement mixes.

F. Ceilings; Base-Coat Mix: Scratch coat for two-coat plasterwork, 1/4 inch (6 mm) thick on concrete.

1. Portland cement mixes.
2. Masonry cement mixes.
3. Portland and masonry cement mixes.
4. Plastic cement mixes.
5. Portland and plastic cement mixes.

G. Plaster Finish Coats: Apply to provide sand texture finish at all exterior walls..

H. Concealed Exterior Plasterwork: Where plaster application will be used as a base for adhered finishes, omit finish coat.

I. Concealed Interior Plasterwork:

1. Where plaster application will be concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
2. Where plaster application will be concealed above suspended ceilings and in similar locations, finish coat may be omitted.
3. Where plaster application will be used as a base for adhesive application of tile and similar finishes, omit finish coat.

3.7 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.8 PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

SECTION 09 28 13
CEMENTITIOUS BACKING BOARDS

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, and services necessary for Cementitious Backing Board Work indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Cement Board and Accessories.

2. Joint Treatment.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Metal Stud Framing System for Interior Work - Section 09 29 00.

2. Tile Work - Section 09 31 00.

1.02 REFERENCE SPECIFICATIONS

A. ASTM International Standard Specifications: As refered to herein, and throughout this section.

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

2. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C.

1.03 QUALITY ASSURANCE

A. General: All materials, articles, accessories incorporated in the Work shall be type and quality specified herein, and subject to the Architect’s review. Methods of preparation, construction and installation of such materials, articles and accessories shall be strictly in accordance with the accepted standard practices, manufacturer’s printed specifications and/or instructions, the Architect’s Drawings and Specifications, and as directed by the Architect.

1.04 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

C. General: Submit Product Data to Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

1.05 DELIVERY AND STORAGE

A. General:

1. Deliver all materials to the site in their original protective wrappings and/or packages, clearly labeled with pertinent information to facilitate checking. Unload in areas designated by the General Contractor. Damaged or deteriorated materials shall be removed from the premises.

2. When material delivery schedules necessitate delivery of the materials before the building is enclosed, or prior to installation of the materials, provide storage and weathertight protection from damage and exposure to the elements in the form of an enclosed shelter of frame construction, with solid wall sheathing and a pitched roof, for the temporary storage of the materials. A waterproof covering of allboard in lieu of the temporary building is not acceptable.

B. Cement Board: When delivered, the cement board panels with unbroken bundling tape shall be neatly piled flat on the floor without overlapping the floor. Storage area shall be protected from the weather.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.06 PROJECT ENVIRONMENTAL CONDITIONS

A. Interior cement board panel installations; during installation, maintain temperatures in the building within the range of 40°F. to 100°F.

B. Provide adequate ventilation to carry off excess moisture.

C. Cement board panels shall not be installed when the board is wet.

1.07 INSPECTION

A. Carefully inspect all surfaces upon which the Work of this section is to be installed; and notify the General Contractor, in writing, for correction, of any condition, detrimental to the installation of this Work. The installation of any materials of this section will be considered this Contractor's acceptance of the field conditions. Therefore, if any defective Work is covered in, remove and replace the affected Work of this section, without extra cost to the Owner.

B. Steel stud wall framing to receive cement board panels shall be structurally sound, free from bow, and in general compliance with local building code requirements. Damaged and excessively bowed studs shall be replaced before installation of cement board panels. Framing shall be designed (based on stud properties alone) not to exceed L/360 deflection for tile. Steel stud framing must be 20 gauge or heavier with corrosion-resistant metal coating equivalent to G60 hot-dipped galvanized.

1.08 SCAFFOLDING

A. Provide, erect, and maintain all scaffolding, ladders, etc., as required by field conditions, all in accordance with the standards of all governing local, state, and national safety codes, as required for the performance of all Work of this section of the Specifications. Such equipment shall be erected at times and locations so as not to delay any part of this or any other Work. When no longer required, promptly dismantle the equipment and remove same from the site.

1.09 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

PART 2 - PRODUCTS

2.01 A. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 CEMENT BOARD AND ACCESSORIES

A. Manufacturer: Products specified herein, unless otherwise indicated, shall be as manufactured by United States Gypsum Company, 550 West Adams Street, Chicago, IL 60661, (800)874-4968.

B. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

1. Interior Cement Board Panels: DUROCK® Brand Cement Board, 1/2" thickness, noncombustible cement backerboard substrate excedding ANSI A118.9 for cementitious backer units, provided in widths and lengths as required by Drawings and/or field conditions.

a. Material Composition: Cement board shall be formed in a continuous process of aggregated Portland cement slurry with polymer-coated, glass-fiber mesh completely encompassing edges, back and front surfaces. The edges shall be formed smooth, and ends square cut.

b. Edges: Formed smooth.

c. Ends: Square cut.

d. Strength: High flexural strength, bend resistant to prevent finish cracking. Boards shall have high compressive strength to resist impact damage.

e. Surface Finishes: Cement board shall have dual surface finishes; a smooth surface side for mastic applications; and a textured surface side for mortar applications.

f. Surface Burning Characteristics: Test in accordance with ASTM Standard E84.

1) Flame Spread maximum 5, and Smoke Developed 0.

2. Accessories: Provide accessory items and Prep products as recommended and acceptable with the specified cement board manufacturer.

a. Joint Reinforcement Material: DUROCK™ Brand Joint Tape, not less than 2" wide (alkali-resistant) glass-fiber mesh tape.

b. Fasteners: DUROCK™ Brand Screws (No. 8) corrosion-resistant, 8-gauge, wafer head wood and/or steel screws with self-drilling points and countersinking ribs to prevent strip-out. Both wood and/or steel screw

types shall have heads with a minimum of 0.40" in diameter; driving recess shall be a No. 2 “Phillips” design. Provide types and of lengths as recommended by cement board manufacturer for installations as indicated on the Drawings and/or required by field conditions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 CEMENT BOARD INSTALLATIONS

A. Interior Walls: Install interior cement board over metal stud framing at locations as indicated on the Drawings to receive wall tile.

B. General:

1. Inspect the metal stud framing and verify proper placement. Studs shall be straight line, with no protrusions from the line of the studs, such as screws and nail heads, mounting brackets and flanges of electrical outlet boxes. Interior metal stud framing shall be a maximum of 16" O.C.

2. Report to the General Contractor, in writing, any metal stud framing conditions of poor placement, protrusions, or other conditions interfering with the proper installation of cement boards. Installation of cement boards without notification shall be considered Contractor’s acceptance of the metal stud framing, and claims for failure of cement board Work because of unsatisfactory framing conditions will not be allowed. Contractor shall be responsible for all faulty Work resulting from improper installation of the cement boards.

C. Installation: Cement board shall be installed in accordance with the manufacturer’s written instructions and as specified herein.

1. Panel Application: Pre-cut board to required sizes and make necessary cut-outs. Fit ends and edges closely but not forced together, leaving a 1/8" gap. Install board abutting top of spacer strip. Stagger end joints in successive courses. Fasten cement board to steel studs spaced maximum 16" O.C. and bottom runners with steel screws spaced 8" O.C. with perimeter fasteners at least 3/8" and less than 5/8" from ends and edges.

2. Prohibited Fasteners: Do not use drywall screws or drywall nails.

D. Joint Treatment Application: Prefill all cement board joints, and joints where cement boards abut other panels or surfaces such as gypsum board, with mortar as specified herein, and then immediately embed tape and level the joints.

3.03 CLEAN-UP

A. During progress of the Work, keep the premises free of all debris and waste materials resulting from the Work of this section. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish to central area designated for clean-up by the General Contractor. Remove all unused materials, tools, and equipment from site.

B. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 09 29 00
GYPSUM WALLBOARD

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, and services necessary for Gypsum Wallboard Work indicated on the Drawings and specified herein. Work includes, but is not limited to the following:

1. Gypsum Wallboard Materials and Accessories.

2. Sound-rated Construction.

3. Non-Load Bearing Metal Stud Framing for Interior Work.

4. Load-Bearing Metal Stud Framing for Interior Work.

5. Suspension System for Gypsum Wallboard.

6. Fire-Rated Wall Construction.

7. Gypsum Sheathing Panels and Accessory Materials.

8. Sanding preparation for painting.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Concrete Form Work - Section 03 10 0.

2. Unit Structural Masonry - Section 04 23 00.

3. Cold-Formed Metal Framing- Section 05 40 00.

4. Miscellaneous Metal Work - Section 05 50 00.

5. Rough Carpentry Work - Section 06 10 00.

6. Thermal Insulation - Section 07 21 00.

7. Board Insulation - Section 07 21 2.

8. Plaster Veneer System - Section 07 24 00.

9. Joint Protection - Section 07 90 00.

10. Aluminum Framed Entrances and Storefronts - Section 08 41 13.

11. Tile Work - Section 09 31 00.

12. Acoustical Panel Ceiling - Section 09 51 13.

13. Resilient Bases and Accessories- Section 09 65 13.

14. Paint and Coatings - Section 09 90 00.

1.02 REFERENCE SPECIFICATIONS

A. ASTM International Standard Specifications: As refered to herein, and throughout this section.

1. ASTM C11 - Standard Terminology Relating to Gypsum and Related Building Materials and Systems.

2. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

3. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.

4. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

5. ASTM C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

6. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.

7. ASTM C1396 - Standard Specification for Gypsum Board.

8. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C.

1.03 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

C. Product Data: Submit Product Data for each type of product specified.

D. Shop Drawings:

1. Load Bearing Framing: Include placing drawings for framing members showing size and gauge designations, number, type, location, and spacing. Indicate supplemental strapping, bracing, splices, accessories, and details required for proper installation. Detail connections to structural steel and structural concrete. Indicate member gauges, spacing, and sizes.

2. Structural Calculations: Submit complete structural calculations for load bearing metal stud framing indicating loads, stresses, and deflections for members and connections. Calculations shall be sealed by a Professional Engineer licensed in the State of the proposed Project, experienced in the design of light gauge framing.

1.05 SYSTEM REQUIREMENTS

A. Performance Requirements: Fabricate and install systems as indicated but not less than that required to comply with ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products, under the following conditions:

1. Gypsum Board Partitions:

a. Standard Systems: Maximum deflection of L/240 of partition height.

b. Systems to receive Water-Resistant Gypsum Board or Cement Backer Board: Maximum deflection of L/360 of partition height.

2. Interior Suspended Ceilings and Soffits: Maximum deflection of L/360 of distance between supports.

B. Acoustical Ratings: Where sound ratings are indicated, provide materials and application procedures identical to those tested by manufacturer to achieve Sound Transmission

Class (STC) scheduled or indicated in accordance with ASTM E90 - Standard Test ethod for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

1.06 DELIVERY AND STORAGE

A. General:

1. Deliver all materials to the site in protective wrappings, clearly labeled with pertinent information to facilitate checking. Unload in areas designated by the General Contractor.

2. When material delivery schedules necessitate delivery of the materials before the building is enclosed, or prior to installation of the materials, provide weathertight protection in the form of frame construction, with solid wall sheathing and a pitched roof, for the temporary storage of the materials. A waterproof covering of wallboard in lieu of the temporary building is not acceptable.

B. Gypsum Wallboard: When delivered, the wallboard with unbroken bundling tape shall be neatly piled flat on the floor without overlapping the floor. Storage area shall be protected from the weather.

C. Material Shelf Life: Do not retain material at the jobsite which has exceeded the shelf life recommended by the manufacturer.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.07 PROJECT CONDITIONS

A. Exterior gypsum soffit panel application and joint finishing, exterior Work temperature shall be a minimum of 55°F.

B. Interior gypsum panel application and joint finishing within the building, maintain temperatures within the range of 55°F. to 70°F.

C. Provide ventilation to remove excess moisture.

D. Rooms or areas in which Work is to be installed shall be at temperatures as specified herein, twenty-four (24) hours prior to installation to at least five (5) days after completion of installation. Refer to Division 00 “Supplementary Conditions” for description of temporary heat.

1.08 SCAFFOLDING

A. Furnish, erect, and maintain all scaffolding and ladders in accordance with local, state, and national safety codes. Equipment shall be erected at times and locations so as not to delay any part of Work. When no longer required, promptly dismantle equipment and remove from site.

1.09 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

1.10 MATERIAL DELIVERY, STORAGE & HANDLING

A. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

PART 2 - PRODUCTS

2.01 A. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 GYPSUM WALLBOARD MATERIALS AND ACCESSORIES

A. Gypsum Wallboard: ASTM Standard 48" wide sheets with tapered or rounded (eased) edges, in lengths as long as practical to minimize jointing, of thickness shown on Drawings, as manufactured by United States Gypsum Company, a subsidiary of USG Corporation; National Gypsum Company; or G-P Gypsum Corporation. Provide the following types:

1. Standard Gypsum Wallboard: ASTM Standard C1396 (formerly ASTM Standard C36).

2. Type X Fire-Rated Gypsum Wallboard: ASTM Standard C1396 (formerly ASTM Standard C36).

3. Water-Resistant Gypsum Wallboard: ASTM Standard C1396 (formerly ASTM C630).

4. Foil-Back Standard Gypsum Wallboard: ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. Joint Tape, Joint Cement, and Adhesives:

1. Joint Tape: Perforated paper tape made especially for drywall joint reinforcing, conforming with ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

2. Joint Cement: Two compound system (joint compound and topping compound) conforming with ASTM Standard C475.

    a. Provide special joint cement recommended by manufacturer for water-resistant gypsum board.

3. Adhesives: Provide adhesives conforming to ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Frame, as recommended by the wallboard manufacturer.

    a. Volatile Organic Compounds (VOC) Content: paint and coatings product specified herein shall have a VOC content of 50 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

C. Metal Stud Framing Systems:

1. Non Load-Bearing: Framing system consisting of metal studs of sizes required for wallthicknesses, or of sizes noted on the Drawings, with mating floor and ceiling track, and all erection accessories. Studs and tracks shall be of cold rolled steel channels conforming to ASTM Standard C645, with an electro-galvanized finish, of not less than the following thicknesses.

    a. 25 gauge thick for partitions up to 16'-0" high at 16" O.C.

    b. 20 gauge thick for partitions over 16'-0" high (but less than 18'-0" high), at 16" O.C.

    c. Where partitions of greater height are required by the Drawings, a heavier gauge shall be required and shall be subject to the Architect's review.

2. Load-Bearing: Galvanized steel framing system conforming to ASTM C955 – Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; shall be 20 gauge (min.) “SJ” style stud members (“C” type studs with stiffening ribs) of sizes and lengths noted on Drawings, with mating running track, and all required erection accessories such as lintels, strappings, clip angles, joists, as manufactured by United States Gypsum Company.

3. Recycled Content of Steel Products: Provide products with an recycled content of steel so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

D. Steel Channels: 1-1/2" cold rolled steel channels weighing not less than 475 pounds per 1000 linear feet; 2-1/2" cold rolled steel channels weighing not less than 800 pounds per 1000 linear feet. All channels shall be galvanized.

1. Recycled Content of Steel Products: Provide products with an recycled content of steel so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

E. Furring Channels: Provide furring widths (depths) as noted on the Drawings.

1. Hat-Shaped Channels: Cold rolled, electro-galvanized sheet steel, United States Gypsum Company, #DWC-25, 7/8" deep, 25 gauge minimum, conforming to ASTM Standard C645.

2. Z-Furring Channels: Interior Framing Product, Z-Furring (ZF-Series) as manufactured by Dietrich Metal Framing, 200 Old Wilson Bridge Road, Columbus, OH 43085, (800)873-2604. Furring channels shall be 25 gauge (minimum) corrosion resistant galvanized steel, conforming to ASTM Standards A653 and A754.

3. Recycled Content of Steel Products: Provide products with an recycled content of steel so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

F. Felt Protection Strips: Provide Type I, No. 15, unperforated felt conforming to ASTM D226 – Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing, in width as required to fully cover contact surface area between metal studs and/or furring channels and exterior wall.

G. Hangers: Not less than 8 ga. annealed zinc coated steel wire or 1" x 1/8" unperforated galvanized steel bands.

H. Tie Wire: Stainless steel or annealed zinc coated steel wire, 16 gauge minimum.

I. Screws: Phillips head screw fasteners conforming to ASTM Standard C954, with self-drilling point, self-tapping thread, and rust resistant coating, not less than #6 x 1" long, except as otherwise required for fire resistive ratings.

J. Nails: GWB-54, bright finish, annular ringed nails conforming with ASTM Standard C514 (formerly ASTM Standard C380), of length to provide 3/4" minimum penetration into framing or furring, except as otherwise required for fire resistive ratings.

K. Corner Beads: Formed to an angle of 90 degrees, zinc-coated steel not lighter than 26 gauge (0.0179 inch in normal thickness) with wings not less than 7/8 inch wide and perforated for screws/nails and cement treatment, or formed of zinc-coated steel or protected aluminum with legs approximately 3/4" wide and cemented under pressure with a rubber base adhesive to tough paper jointing tape wings not less than 1" wide. Zinc-coated steel shall conform to Federal Specification QQ-S-775 Type I, Class C.

L. Casing Beads: United States Gypsum Company, USG - No. 200-A galvanized metal trim, or equivalent 26 gauge galvanized casing bead by National Gypsum Company.

M. Control Joints: United States Gypsum Company, USG - Zinc Control Joint No. 093, or equivalent 26 gauge galvanized metal control joint product by National Gypsum Company.

N. Special Trim: Provide where/if indicated, special trim fabricated from No. 26 gauge galvanized sheet steel to the shape shown on Drawings.

O. Angle-Type Hangers: Unless otherwise indicated on the Drawings provide angles with legs not less than 7/8 inch wide, formed from 0.0635 inch thick galvanized steel sheet complying with ASTM Standard A653 (formerly ASTM Standard A446), Coating Designation G90, with bolted connections and 5/16 inch diameter bolts.

2.03 GYPSUM SHEATHING PANELS AND MATERIALS

A. Manufacturers: Panels specified herein shall be as manufactured by Georgia-Pacific Gypsum LLC, 133 Peachtree Street, Atlanta, GA, 30303, (800)947-4497 or (800)225-6119.

1. Comparable Products: Gypsum sheathing panels by manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect’s review.

B. Gypsum Sheathing Panels:

1. At Plaster Veneer System: ASTM Standard C1396 (formerly ASTM Standard C79).

2. At Plaster Veneer System: When extensive winter weather exposure is anticipated, provide square edge, noncombustible, gypsum sheathing panels, in accordance with ASTM Standards E136, C1177 and C1396 (formerly ASTM Standard C79), 1/2" (nominal thickness) Dens- Glass™ Exterior Sheathing (formerly Dens-Glass® Gold Exterior Sheathing with R-Value of 0.56 when tested in accordance with ASTM Standard C518. Gypsum panels shall be made

of a treated, water-resistant core, surfaced with fiberglass mats and a “Gold” colored primer coating.

C. Accessory Materials:

1. Fasteners: Steel drill screws, in lengths recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating.

a. For steel framing less than 0.0329 inch thick, attach sheathing with steel drill screws complying with 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.

b. For steel framing from 0.033 to 0.112 inch thick, attach sheathing with steel drill screws complying with ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 COLD-FORMED (LOAD-BEARING) METAL FRAMING

A. Exterior Metal Framing: Metal framing shown on Drawings for gypsum wallboard sheathing shall be furnished and installed by the Cold-Formed Metal Framing Contractor.

B. Wood Framing and Furring: Wood framing and furring where shown on Drawings for gypsum wallboard finish shall be furnished and installed by the Rough Carpentry Contractor.

C. Load Bearing Metal Stud Framing: Provide load bearing metal stud and joist framing at the following locations:

1. Toilet Room walls and ceilings.

2. As indicated on the Drawings.

3.03 METAL STUD FRAMING (NON LOAD-BEARING TYPE STUDS)

A. Furnish and install non-load bearing metal stud framing for gypsum wallboard partitions, support of gypsum wallboard in locations noted, or where other types of framing are not provided. Framing shall consist of vertical studs framed into continuous top and bottom tracks. Studs shall be of sizes noted on the Drawings or as required to produce the partitions of thicknesses noted, and tracks shall be of mating sizes. In general, framing shall be of single stud depth. Where wall thickness is greater than stud depths, and where plumbing spaces are indicated, frame each wall surface with a separate stud frame.

1. Where partitions are to have gypsum wallboard on both sides, use 25 gauge metal studs for partitions up to 16'-0" high; use 20 gauge metal studs for partitions from 16'-0" to 18'-0" in height.

2. Where partitions are to have gypsum wallboard on one side only, use 25 gauge metal studs for partitions up to 14'-6" high; use 20 gauge metal studs for partitions from 14'-6" to 17'-3" in height. At these partitions (wallboard at one side), provide continuous cold rolled stiffener channels at third points, secured with screws or by welding. Securing by wiring shall not be accepted.

3. The above gauge requirements are based on 3-5/8 inch deep studs at 16" centers. Metal gauges for studs of different depth or spacings shall be subject to review by the Architect.

B. Extend partition framing from floor to underside of finish ceilings, to 6" minimum above finish ceilings, or to underside of metal roof deck construction above, as indicated on the Drawings.

C. Bottom and Top Track Installation:

1. Secure bottom tracks to supporting construction, both ends, corners, jambs of openings, and 24" centers with bolts and metallic expansion sleeves.

2. Where partition framing extends to underside of metal roof deck, secure top track to roof steel framing where perpendicular thereto. Where partitions are parallel to roof steel, brace top track to adjacent building framing with pieces of studs, at 48" O.C., maximum. Insulation Contractor shall furnish safing insulation for top track and where indicated on Drawings.

a. Isolate stud system from transfer of structural loading to system, horizontally and vertically. Provide slip type joints to attain lateral support, allowances for deflection, and avoid axial loading.

3. Where partition framing are ceiling high and ceilings are finished with gypsum wallboard, secure top track through wallboard to ceiling framing, at each intersection.

4. Where partition are ceiling high and ceilings are acoustical ceilings, after acoustic panels above partition are installed, install top track at underside of ceiling grid by bolting the tracks to the grid, separating top track from ceiling with a strip of polyethylene film.

5. In all areas of ceiling high partition, and in areas where framing extends only 4" above finish ceilings, conceal brace the top of the partition to steel framing at 48" O.C., maximum, in the area above the ceilings.

D. Furnish single length, unspliced studs for all locations. Furnish studs cut short to provide a 1/2" space between top of stud and underside of top track. Secure studs at corners, intersections, ends and both sides of openings to bottom track, at both stud flanges, with screws. In all other locations studs shall twist into tracks so as to be held by friction and to permit differential deflection between top and bottom track support construction. NOTE: In fire-rated walls frame fastening shall be in accordance with code requirements governing fire-rated construction.

E. Framing:

1. Frame partition corners by butting one wall against the other, with one stud at the end of the abutting wall and with two studs at the end of the other wall, forming a three stud corner.

2. Frame partition intersections by butting the intersecting wall against the wallboard-finished through-wall, providing two studs at intersection in through-wall, one stud at end of abutting wall, and bolting stud at end of abutting wall to wallboard of through-wall, at 24" O.C.

3. Frame openings with floor track at head and sills, welded to stud at jambs, with jack studs above and below openings to continue stud spacing pattern, omitting sill and bottom studs at door openings. Brace studs at jambs of openings back to first adjacent stud with furring channels at head and at 24" O.C. to floor line, welded in place at both ends.

4. Control joints shall be framed by placing two studs back to back, with a 1/2" open space between backs, and by interrupting tracks with a 1/2" open space, at the joint.

F. Completed framing shall provide straight true, plumb planes to receive the gypsum wallboard. Openings shall be true rectangles.

3.04 CEILING AND SOFFIT FRAMING

A. Furnish and install a concealed framing system for all gypsum wallboard ceilings (except toilet room ceiling), consisting of 1-1/2" runner channels, spaced not over 4'-0" on centers, erected parallel to partitions and walls. Hang suspended ceiling framing from the steel framing above.

B. Hang runner channels from above the hangers spaced at 48" O.C., maximum, along each channel. Erect hangers approximately plumb. Wrap each wire hanger around the runner channel, the steel joist, and around itself three times. If steel band hangers are used, secure each steel band to the runner channel by wrapping tightly around the channel and bolting to itself. All connections shall develop the full strength of the hangers.

1. Do not attach hangers to roof deck, ductwork, duct supports, piping, conduit or hangers for same.

2. Where ductwork or other construction interferes with typical hanger spacing, provide trapezes, or other approved framing, to frame around such items and to support the hangers.

3. Pairs of diagonal hangers, extending from runner at midpoint between joists to top chord of joists at each side may be provided to reduce hanger spacing to 48" centers or less along the runner.

4. Provide additional hangers at light fixtures, diffusers, grilles, and other points of extra loading.

C. Erect runners level, parallel to room walls and parallel to each other. Provide a runner adjacent to, and within 3" of, walls where parallel to same. Provide runners at top and bottom edges of all ceiling drops. Cut off ends of runners 1/2" from walls where perpendicular thereto. Splice, when required, at hangers only, by lapping 12" and securely tying.

D. Where control joint or expansion joint is required by Drawings or Specifications, and runners are parallel to the joint, provide runner channel at each side of joint and secure each, independently of each other, to the framing above. Where runners are perpendicular to the joint, terminate runners at each side of joint, allowing a 1/2" wide, minimum, break in the runners, aligned with joint.

E. Frame and brace all openings in ceilings that have any side dimension over 2 ft. as a part of the suspension system. Provide all required metal framing, bracing, supports, blocking and wedging necessary to install the framing rigidly and securely in position. Do all cutting and drilling required to install and fasten framing and furring in place. Erect runners to true lines, levels and planes so as to provide a true, flat, system or surface to receive the succeeding Work.

3.05 METAL FURRING

A. Furnish and install metal furring to support gypsum wallboard ceilings, ceiling drops, and soffits at the lines and elevations as shown and/or noted on the Drawings.

B. Erect furring in straight continuous rows and in parallel alignment, spaced l6" O.C. Splice furring, where required, by nesting or lapping adjacent members not less than 8" and by double tying the lap splice.

1. At ceilings, ceiling drops, and soffits, erect furring at right angles to supporting framing.

2. Where furring is parallel to edges of wallboard finish, provide a furring member at wallboard edge.

3. Where furring is at right angles to edges of wallboard finish, extend furring to such edges, mitering or coping members at corners.

C. Where control joint or expansion joint is required provide a furring member at each side of joint, along edge of wallboard.

D. Provide steel framing, bracing, shimming and supplementary framing as required to erect furring at the required lines and elevations. Secure furring to ceiling framing runners and to building framing by saddle tying with two (2) strands of tie wire.

E. Direct Metal Stud and/or Furring Channel Attachment to Walls: Where dampproofing is not indicated and/or specified and metal stud and/or furring channel is installed directly to exterior wall, install felt protection strip between metal stud and/or furring channel and wall. Attach metal furring channels, spaced 24" O.C. maximum unless otherwise as noted on the Drawings, to interior of masonry and/or concrete surfaces with hammer-set or power-driven fasteners staggered 24" O.C. maximum on opposite flanges.

3.06 GYPSUM WALLBOARD INSTALLATION

A. Furnish and install gypsum wallboard on the exposed side or sides of stud partition framing and coldformed metal framing, on one side of all furred areas, fire stops, and where shown on Drawings.

1. Unless otherwise indicated on the Drawings, provide multiple-layer wallboard as indicated or required for fire-rated partition construction. Provide single layer wallboard for all other locations.

a. Refer to the Drawings for partition framing construction requiring wallboard to metal roof deck.

b. Provide fire-rated gypsum wallboard where indicated on Drawings.

c. Provide exterior gypsum wallboard sheathing at exterior wall areas for plaster veneer system as indicated on Drawings.

d. Provide water-resistant gypsum wallboard at interior face side of Toilet Room walls, and other locations as indicated on the Drawings.

e. Provide foil-faced gypsum wallboard where indicated on Drawings.

f. Provide standard gypsum wallboard at all other areas.

2. Cover full height of stud partition framing with wallboard, including the portion above ceilings.

3. In all wall and partition Work, except where partition framings terminate at underside of ceilings, extend wall and partition wallboard up past edge of ceiling wallboard, and cope edge of ceiling wallboard to such vertical surfaces forming a control joint.

4. At all control joints, provide a 1/4" wide, straight open joint in the wallboard, at the joint centerline.

5. In addition to the required fastening of wallboard panels vertically, secure gypsum wallboard at partitions with screws 16" O.C. to bottom and top track; at FIRE-RATED PARTITION(S), spacing of screws at bottom and top track shall be 8" O.C.

B. Installations:

1. Single Layer Installations:

a. If wallboard is obtainable in length to span full height in a single piece, install wallboard with long dimension vertical; otherwise install wallboard with long dimension horizontal; with vertical joints aligned over studs or furring in both cases.

b. At soffit/ceiling and soffit/ceiling drop Work, install wallboard with long dimension at right angles to support framing, with end joints aligned over framing members.

c. Apply all wallboard with the reverse side against the framing members, and with the separate boards in moderate contact, but not forced into place. At internal and external corners, conceal the cut edge of the boards with the overlapping covered edge of the abutting board. Stagger

the boards so that the corners of any four boards will not meet at a common point except in vertical corners.

2. Double Layer Installations:

a. Install and secure the base layer of wallboard in accordance with requirements specified above for single layer installation, except wallboard on walls and partitions may be installed with long dimension horizontal in all cases.

b. Apply face layer of wallboard over base layer in same manner and positioning as specified for base layer, off-setting joints not less than 10" from joints of base layer. Secure face layer to base layer with full, uniform coatings of adhesive, applied to both contact surfaces with a brush, roller or serrated spreader. Impact layers together to insure thorough and maximum bonding. Form corners by overlapping board ends of base layer. Provide screw or nail fastening to supplement adhesive fastenings as may be required.
NOTE: At fire-rated installations, supplemental fastening is required, with screws 24" O.C. along center line and edges of each sheet - joints finished.

C. Screw Fastening:

1. Power drive all screws with an electric screwdriver until the screw head provides a slight depression below the surface of the wallboard, but no further. Do not break the paper covering in the board. If the paper surface is broken, place another screw approximately 2 inches from the damaged surface.

2. Screws shall be spaced a maximum of 8" O.C., and not closer than 3/8" to edges. Pair, not stagger, fasteners at edge joints between adjacent sheets.

3. Fastening for vertical and horizontal application shall begin at the top center of the panel and proceed outward to the edges or ends, with the top completed before proceeding. Fastening the field of the panel shall begin with the member nearest the center of the panel and proceed outward to the edges or ends, with the fastening completed on each member before proceeding to the next member.

D. Nail Fastening:

1. Where wallboard is required to be secured to wood furring member, installation shall be with annular nails. Nailing for vertical and horizontal application shall be as specified for screw fastening above, except with maximum (nail) spacings of 7" O.C. at ceilings, and 8" O.C. at walls.

2. Wallboard may also be secured to wood framing members and furring with screws, in which case, the application shall be as specified for screw fastening above, including maximum screw spacings.

3.07 EXPANSION JOINTS AND CONTROL JOINTS

A. Expansion Joints: Provide expansion joints where noted on the Drawings and/or required by field conditions. Provide two (2) metal casing beads, back to back, with open space of size detailed on Drawings between backs, at expansion joint centerlines.

B. Control Joints: Where not indicated on Drawings, gypsum panel surfaces shall be isolated with control joints where partition or furring run exceeds 30 ft.; where soffit/ceiling dimensions exceed 50 ft. in either direction, or area within separate soffit/ceiling sections exceeds 2,500 sq. ft.; where wings of “L”, “U”, and “T” shaped soffit/ceiling areas are joined; where soffits/ceilings abut partition or vertical surface; and where expansion or control joints occur in base exterior wall. Back joint by double studs or furring channels.

1. Where soffits/ceilings abut partitions or vertical surfaces, install dust stop gasket (with slight fullness to allow for movement of joint), then install soffit/ceiling wallboard with metal casing bead at exposed edge, forming a 1/8" to 1/4" wide open space between the abutting surfaces. Casing beads shall be flushed with wallboard in same manner as hereinafter specified for edge treatment.

2. Install at all other control joint locations, approved, roll-formed zinc control joints, attaching with Bostich® 9/16" “G” staples, or approved equal, spaced not over 6" apart. Cut end joints square and align for neat fit. Control joint shall then be given joint finishing treatment as hereinafter specified. Remove protective tape when joint treatment is completed.

3.08 SOUND-RATED CONSTRUCTION:

A. Insulation: Coordinate with Acoustic Insulation Contractor for installation of acoustic insulation in sound-rated partitions where indicated on the Drawings.

B. Gypsum Board:

1. Install gypsum board same as for interior partitions and ceilings.

2. Coordinate with installation of perimeter sealants.

3. After installation of gypsum board base layer(s), cut face layer sheets 1/2 inch less than floor-to-ceiling height and position with 1/4 inch open space between gypsum board and floor, ceiling and dissimilar vertical construction.

C. Sound Flanking Paths: Where sound-rated partition walls intersect non-rated gypsum board partition walls, extend sound-rated construction to completely close sound flanking paths through non-rated construction.

3.09 CORNER AND EDGE TREATMENT

A. Internal Corners: Treat all exposed internal corners, as specified herein under Article for FINISHING. Reinforcing tape shall be folded lengthwise through the middle and fitted neatly into the corner.

B. External Corners: At external corners neatly fit a corner bead over the corner and secure with the same type screws used for applying wallboard. Space screws approximately 6 inches on centers, driving through the wallboard into the framing member. After the corner piece has been secured in place, treat the corner with joint cement and reinforcing tape in the manner as specified herein under Article for FINISHING. Feather final coat of topping compound out from 12 to 16 inches on both sides of corner.

C. Edges: Finish all exposed edges of wallboard, including perimeter of all soffit/ceiling areas, and edges abutting masonry, concrete, door frames, window frames, and other finish construction, with metal casing beads. Casing beads shall be flushed with wallboard surface in manner herein before specified for external corners, topping compound feathered out from 12 to 16 inches to surfaces of wallboard.
All Work shall be sanded smooth when dry.

3.10 FINISHING

A. Levels of Finish: Provide levels of gypsum board finish for locations as follows, in accordance with Gypsum Association GA-214, “Recommended Levels of Gypsum Board Finish”.

1. Level 1: All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.

    a. Locations: Provide Level 1 finish for gypsum board surfaces in ceiling plenum areas and concealed areas, except provide higher level of finish as required to comply with fire resistance ratings and acoustical ratings.

2. Level 2: All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.

a. Locations: Provide Level 2 finish for gypsum board substrate at tile and FRP panels, except remove tool marks and ridges.

3. Level 3: All joints and interior angles shall have tape embedded in joint compound and one (1) additional coat of joint compound applied over all joints and interior angles. Fastener heads and accessories shall be covered with two (2) separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: The prepared surface shall be coated with a drywall primer by the Painting Contractor prior to the application of final finishes as specified in Division 09.

a. Locations: Provide Level 3 finish for gypsum board surfaces, where heavy- or medium textured finishes or heavy-grade vinyl wallcovering will be used.

4. Level 4: All joints and interior angles shall have tape embedded in joint compound and two (2) separate coats of joint compound applied over all flat joints and one (1) separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three (3) separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: The prepared surface shall be coated with a drywall primer by the Painting Contractor prior to the application of final finishes as specified in Division 09.

a. Locations: Provide Level 4 finish for gypsum board surfaces, where smooth flat paints, light textures, or light- or medium-grade wallcoverings are to be applied.

B. Interior Gypsum Board:

1. Prefill:

a. Use setting-type joint compound. Mix joint compound according to manufacturer’s directions.

b. Fill joints between boards flush to top of eased or beveled edge.

c. Wipe off excess compound and allow compound to harden.

2. Taping (Level 1):

a. Use taping or all purpose compound.

b. Butter taping compound into inside corners and joints.

c. Center tape over joints and press down into fresh compound.

d. Remove excess compound.

e. Tape joints of gypsum board above suspended ceilings.

3. First Coat (Level 2):

a. Use taping or all-purpose drying-type compound, or setting-type joint compound.

b. Immediately after bedding tape, apply a thin skim coat of joint compound trowel applied over body of tape and allow to dry completely in accordance with manufacturer's instructions.

c. Apply first coat of compound over flanges of trim and accessories, and over exposed fastener heads and finish level with board surface.

4. Second Coat (Level 3): Use all purpose or topping drying type joint compound. After first coat treatment is dried, apply second coat of compound over tape and trim, feathering compound 2 inches beyond edge of first coat.

5. Third Coat (Level 4):

a. Use all purpose or topping drying type joint compound.

b. After second coat has dried, sand surface lightly and apply thin finish coat to joints, fasteners and trim, feathering compound 2 inches beyond edge of second coat.

c. Allow third coat to dry. Apply additional compound, and touch-up and sand, to provide surface free of visual defects, tool marks, and ridges, and make suitable and ready for
application of final finish by others.

C. Water-Resistant Gypsum Board: Treat fastener heads and joints with setting-type joint compound.

1. For joints to be covered with tile, apply tape and joint compound bedding coat and skim coat only; do not apply finish coats.
a. Do not crown joints or leave excess compound on panels.

b. Remove tool marks and ridges.

c. For fastener heads to be covered with tile, apply one (1) coat of joint compound.

D. Joint Compound:

1. After skim coat sets, apply finish coat of compound feathering 3 to 4 inches beyond tape edges.

2. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch.

E. Trim:

1. Use same fasteners to anchor trim accessory flanges as required to fasten gypsum board to supports, unless otherwise recommended by trim manufacturer.

2. Install metal corner beads at external corners.

3. Install metal casing bead trim whenever edge of gypsum base would otherwise be exposed or semi-exposed, and where gypsum base terminates against dissimilar material.

F. Control Joints: Install where indicated and specified.

G. Special Trim and Reveal Joints: Install as indicated on Drawings and in accordance with manufacturer’s instructions.

3.11 GYPSUM SHEATHING PANELS

A. Preparation: Examine exterior metal stud framing and verify that the surface of the framing members to receive the sheathing does not vary more than 1/4" from the plane of faces of adjacent members.

1. Inspection: Steel framing stud spacing shall not exceed 16 inches O.C. for 1/2 inch thick gypsum sheathing panels and 24 inches O.C. for 5/8 inch thick gypsum sheathing panels.

2. Notification: Contact the General Contractor, in writing, for correction, of any condition, detrimental to the installation of this Work.

B. Sheathing Installation: Provide sheathing where indicated on the Drawings and as specified herein. Install sheathing in accordance with ASTM Standard C1280 and the manufacturer’s written installation instructions and recommendations.

1. Fiberglass-faced gypsum sheathing, where indicated on the Drawings, over metal stud framing shall be installed with the “gold side” out (exposed to exterior view/side).

a. Fasteners shall be flush to the face of the board, not countersunk.

b. Do not laminate sheathing to masonry surfaces.

3.12 SURFACE PREPARATION FOR PAINTING

A. Where painting of gypsum wallboard surface or vinyl wallcovering is indicated on the Drawings, tape, spackle and sand flush all surface imperfections, cracks, and gouges to make suitable for finish painting by the Painting Contractor.

3.13 CLEAN-UP

A. During progress of the Work, keep the premises free of all debris and waste materials resulting from the Work of this section. During progress of the Work, upon completion of Work, and before final acceptance of the Work, remove all debris and rubbish to central area designated for clean-up by the General Contractor. Remove all unused materials, tools, and equipment from site.

B. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 09 31 00
THIN-SET TILE WORK

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, apparatus, tools, transportation, protection and services necessary for, and reasonably incidental to the proper execution and completion of all Thin-Set Tile Work as indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Porcelain, Ceramic Floor and Wall Tiles.

2. Special Tile Shapes.

5. Setting Materials, Accessories, and Sealants.

B. Color Selections: Refer to Color Legend on the Drawings.

C. Room Finish Schedule and Colors: Refer to the Drawings.

D. Related Sections: The following Work will be provided under other sections of the Specifications:

1. Concrete Floors - Section 03 30 00.

2. Block Masonry - Section 04 20 00.

3. Carpentry Work - Section 06 10 00.

4. Caulking - Section 07 90 00.

5. Glass, Glazing, and Aluminum Work - Section 08 41 00.

6. Cement Board Panels - Section 09 28 13.

7. Gypsum Wallboard - Section 09 29 00.

8. Resilient Bases and Accessories - Section 09 65 13.

9. Resilient Tile Flooring - Section 09 65 19.

10. Tile Carpeting - Section 09 68 13.

11. Fiberglass Panels - Section 09 77 00.

12. Interior Painting - Section 09 91 23.

13. Toilet Partitions - Section 10 21 13.

14. Entrance Mats - Section 12 48 13.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Requirements of Regulatory Agencies: Furnish and install all Tile Work in strict compliance with the laws, codes, ordinances and regulations of the public authorities having jurisdiction, including Title III of The Americans With Disabilities Act (ADA), Public Law 101-336.

B. References: Unless otherwise specified herein, all tile materials, installation, and workmanship shall conform to the following:

1. American National Standards Institute (ANSI):

a. A108.5 Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex- Portland Cement Mortar.

b. A118.1 Specifications for Dry-Set Portland Cement Mortar.

c. A118.3 Specifications for Chemical-Resistant, Water-Cleanable Tile-Setting and Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.

2. Tile Council of North America, Inc. (TCNA): Amercian National Standards Specifications for Ceramic Tile - ANSI 137.1, current edition.

C. Codes and Ordinances: Where requirements of governing Federal, Local and/or State Codes and Ordinances are more stringent than the requirements specified herein, the requirements of such Codes and Ordinances shall govern, as applicable.

1.03 QUALITY ASSURANCE

A. General: Contractor for Tile Work shall be responsible for an acceptable completed installation for areas designated to be tiled. Work shall be in complete conformity to the type of tile, dimensions, colors, grades, patterns, and necessary trim units as shown on Drawings and/or required by field conditions.

B. Installer: Firm shall have specialized in Tile and Countertop Work for a period of not less than five (5) years of proven successful experience satisfactory to the Architect and/or Owner. Work shall be performed by qualified workmen in a manner conforming to best current practice of the trade.

C. Performance Requirements: Tiles and countertops shall be new materials conforming to performance requirements as specified herein. Materials of “second” quality not meeting or exceeding the requirements of these Specifications shall not be accepted.

D. Material Shelf Life: Do not retain setting and sealant materials at the jobsite which have exceeded the shelf life recommended by the manufacturer.

E. Tile Mock-Ups: Prior to installation Work, lay-out in the building, full-size mock-ups of each tile pattern to be used in the Work.

1. Sample areas shall be prepared in the building where and as directed by the Architect and/or Owner’s Supervising Engineer.

2. Size of Sample area shall be as designated by the Architect.

3. Remove tile mock-up as directed by Architect.

F. Visual Approvals: Obtain Architect and/or Owner’s Supervising Engineer acceptance of visual qualities of the Work during progress of the Work before proceeding with the Work.

1.04 SUBMITTALS

A. General: Submit Samples, Product Data, and Certificates to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

1. Mark each tile and/or marble Sample legibly, with the Identity of the Sample, the Name of the Installer, the Name of the Project, and the Location in the Building.

B. Tile Samples: Submit two (2) full size Samples of each type (including special shapes) and colors of tile, and provide letters of intent to the Architect, for review and approval prior to starting the Work.

C. Marble Threshold Samples: Submit two (2) Samples not less than 3" x 5", of marble in thickness required.

D. Granite Countertop Samples: Submit two (2) Samples not less than 6" x 6", of granite in thickness required.

E. Sealant Samples: Submit Samples of sealant for review and approval by the Architect. Do not commence Work until the Architect's written approval of the Samples has been received.

1. Submit two (2) Samples of each color required for each sealant exposed to view. Install Sample between two (2) Samples of tile and/or marble material representative of typical joint widths.
Manufacturer's color charts and/or color swatches will not be acceptable as Samples.

F. Grouting Mortar Samples: Submit two (2) Samples of each color required for review and approval by the Architect. Do not commence Work until written approval from the Architect has been received.

G. Metal Edge Trim Strip Samples: Submit two (2) 12" long Samples of metal edge trim angle strip for Architect's review and approval.

H**.** Product Data: For information only, submit two (2) copies of manufacturer's technical information and installation instructions for all materials required, except bulk materials.

I. Certificates: Before proceeding with the Tile Work, furnish the Architect with a Master Grade Certificate, in the form shown in the TCNA Al37.l signed by the manufacturer and the Contractor certifying the grade, type, and quantity of each kind of tile, together with adequate information for identification of the containers to which they apply.

1.05 PRODUCT DELIVERY

A. Delivery: Deliver all products in original, unopened containers, branded or labeled with the proper grade seal. Mark all containers with designations corresponding with information given on the grade certificates. The containers shall be subject to inspection by the Architect before being opened, as well as during the progress of the Work.

B. Storage: Store and protect materials within waterproof enclosures to prevent water absorption. Handle materials to prevent damage.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.06 PROJECT CONDITIONS

A. Schedule installation of tile with the Owner's Representative to assure completion of all Tile Work, including all protective measures, prior to receipt and installation of Tenant and/or Owner supplied fixtures, equipment, furnishings, etc.

B. When installing tiles and marble over new concrete slabs, do not start installation until concrete has cured for at least five (5) days and then aged for fourteen (14) additional days, or for such additional time as required for the concrete to have shrunk and attained equilibrium.

C. Install tiles when ambient air temperatures, and temperatures of all materials, is 55°F. or higher. Rooms or areas in which Work is to be installed shall be at temperatures of 55°F. or higher twenty-four (24) hours prior to installation to at least five (5) days after completion of installation. Refer to Division 0 “Supplementary Conditions” for description of temporary heat.

1.07 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner’s acceptance of the installation.

B. Systems Guarantee: Obtain from the setting materials manufacturer, a written Systems Guarantee, guaranteeing that the products specified herein shall be free from manufacturing defects and will not break down or deteriorate for a period of not less than five (5) years from the date of the installation, when installed in accordance with the manufacturer’s written specifications and guidelines.

1.08 EXTRA MATERIAL

A. General: Not less than 30 days prior to opening of the facility, deliver to the Owner’s Representative, the following materials for future use. Materials shall be delivered with a list of manufacturer’s names, product designations, addresses, and phone numbers. Materials shall be boxed, sealed, and clearly identified as to product and specific location of use. Furnish the following quantities of material for use within the designated area.

1. 1% of the total of each color, size, and shape of the tile used, including bases.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Tile Manufacturer:

1. As specified in drawings.

B. Tile Products: Provide tile products of manufacturers, product lines, colors and sizes as noted on the Drawings.

C. Tile Installation Products:.

1. Mapei setting and grouting materials as specified herein shall establish the commercial standard of quality and performance required. Mapei® tile installation products as manufactured by Mapei Corporation, 1144 East Newport Center Drive, Deerfield Beach, FL 33442, (954)246-8888 or (800)426-2734; www.mapei.com, will be acceptable, and subject to review by the Architect.

2.03 SPECIAL SHAPES

A. General: Provide special shapes, such as wall base materials, trim pieces, interior cove, corner bullnose, and exterior/interior corner units, to be used in their respective places as required by the Drawings and/or field conditions.

2.06 SETTING MATERIALS

A. Portland Cement Mortar: Unless otherwise specified, tile setting materials shall be LEED Approved products, as manufactured by Mapei Corporation, 1144 East Newport Center Drive, Deerfield Beach, FL 33442, (954)246-8888 or (800)426-2734; www.mapei.com. Materials shall be products licensed by the Tile Council of America, and bear TCA triangular hallmark on containers.

1. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

B. Grouting Mortar: Mortar for the various applications shall be as specified herein.

1. Grout shall be MAPEI, Ultra Color Plus, Color to match adjacent material, 3/16” thick, unless otherwise noted in the Construction Documents. Verify with Architect if discrepancies arise.

2. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

C. Sand: Conform to ASTM Standard C144, clean, washed, sharp durable, uncoated aggregate free from all deleterious substances; uniformly graded from coarse to fine with 100% passing a No. 30 mesh screen and not more than 5% passing a No. 100 mesh screen.

D. Water: Potable water (suitable for drinking) shall be clean, free from oils, alkalies, acids, organic water, or other deleterious materials.

E. Epoxy Adhesive: Latapoxy® 310 Stone Adhesive, two-component, non-sag, high strength construction epoxy adhesive, meeting and exceeding ANSI A 118.3.

1. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2.07 METAL EDGE TRIM STRIPS

A. Manufacturer: Schluter Systems L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901-5841, (800)472-4588; www.schluter.com, or comparable equivalent manufacturer's product subject to review by the Architect.

B. Product: Edge-protection trim "Schluter®-Schiene-A", mill-finished aluminum material, sizes as indicated on the Drawings and/or required by field conditions. Exposed finish surface width of the edge trim shall be not less than 1/8". Wall thickness for the perforated installation leg shall be 0.039" or 1mm.

2.08 SEALANTS

A. Floor Joint Sealant: Dynatred®, Non-Sag, Traffic-Grade Polyurethane Sealant, two-part, chemically curing, cold-applied elastomeric sealant, conforming to Federal Specification TT-S-00227E, as manufactured by Pecora Corporation, 165 Wambold Road, Harleysville, PA 19438, (215)723-6051 or (800)523-6688.

1. Primer: As recommended by the specified sealant manufacturer.

2. Colors: Sealant color shall match grout joint colors, and shall be subject to review and approval by the Architect and/or Owner.

3. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 250 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

PART 3 - EXECUTION

3.01 INSPECTION

A. Surface Inspections: Carefully inspect all surfaces upon which materials will be applied, and report to the General Contractor in writing, any condition detrimental to the installation, for correction prior to proceeding with the Work. The installation of Tile Work will be considered an acceptance of the surfaces to be covered, and claims for failure of Tile and Countertop Work because of unsatisfactory sub-surfaces will not be allowed.

B. Concrete Floor Slab Tolerance Flatness/Levelness: Floor shall comply with ASTM E1155 – Standard Test Method for Determining F_F Floor Flatness and FL Floor Levelness Numbers; using the F-Number System.

1. If concrete floor slab surfaces exceed the maximum variation, Tile Contractor shall notify the General Contractor for correction of any defects. Starting Work shall imply acceptance of the job conditions, and an unsatisfactory surface condition for the installation of the materials will not be considered valid in waiving any portion of the warranty.

3.02 PREPARATION

A. Prepare all surfaces upon which materials will be applied as required to receive Work. Remove all dirt, grease, oil, paint, and other surface contaminations that will prevent proper bonding from the substrate surfaces. Remove all ridges, fins, projections, high spots and other irregularities that would interfere with proper installation Work.

3.03 LAYOUT, CUTTING, AND FITTING

A. Layout all Tile Work to minimize cuts of less than one-half tile in size.

B. Locate cuts to be inconspicuous.

C. Align all floor joints to have straight, uniform grout lines parallel with adjacent walls and surfaces.

D. Whenever possible, align grout joints of wall tile and base tile with floor tile joints.

E. Neatly cut and accurately fit all Tile Work around piping and other installations which pierce the Tile Work; at irregular shaped places; and at the junction with other materials. The surface of the tile shall not be chipped or otherwise be damaged in cutting. Grind cut edges smooth and even.

3.04 WORKMANSHIP AND APPLICATION

A. General: Install tile as indicated on the Drawings and specified herein.

1. Select tile from the same shade and lot number.

2. Visually inspect the tile prior to installation.

3. Mix tiles from several boxes.

4. Rotate the tiles to ensure a non-repeat look.

B. Installations: Work shall be performed according to industry standards, manufacturer's written specifications, and reference standards.

C. Porcelain Ceramic Floor Tile Applications - Thin Bed (Thin Set) Method:

1. Mixing requirements as per Mapei product requirements.

    a. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2. Apply the mortar with the flat side of the trowel, being sure to work the material into the surface of the concrete substrate. Comb the surface of the mortar with the notched side of the trowel. Use the proper size notched trowel for the size of tile to be installed.

3. Before placing tiles into the fresh mortar, wipe the back of each tile with a damp sponge or "Scotch Brite™" pad, to remove any dirt or dusty release agents on the tile backs to enhance the bonding strength.

4. Apply mortar to the back of the cleaned tiles to completely cover the back of the tile with a minimum 3/32" to 1/8" uniform thickness.

5. Place the tiles while the mortar is wet and tacky and beat the tile with a rubber mallet and beating block to firmly bed the tiles into the mortar. Occasionally lift a tile off the mortar bed to check for proper coverage of the mortar. Before hardening, excess mortar shall be cleaned with a damp sponge. Tiles may then be grouted when firmly set.

6. Grouting: Provide stain resistant, colorfast, epoxy grout "Mapei". Exposed joint widths based on manufacturer's tiles as specified herein shall be typically 1/4" wide for nominal 6" x 6" tiles and 5/16" wide for nominal 12" x 12" tiles. Note: Joint widths for use with other manufacturer's products shall be verified with the Architect.

    a. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

    b. Preparation: Before starting to grout, remove debris in grout joints and lightly sponge the tile surface to remove all dust and dirt. Water shall not be left standing in joints.

    c. Installation Method:

1. Empty entire contents of packed liquid premeasured kit product jars into a clean pail/container using a clean mixing stick or margin trowel. Mix thoroughly for one minute. Add at least 3/4 of powder product, using more powder for wider joints, as recommended by the manufacturer.

2. Immediately pour entire content of pail/container onto working area. Use standard epoxy grouting techniques to work grout into grout joints. Insure that all grout joints are fully packed.

3. Clean-up by using a hard epoxy rubber grout float at 90° angle to remove as much excess material as possible before initial cleaning with nylon scrub pad. Do not leave excess grout on the face of tiles.

4. Wash the installation within 12 to 24 hours after grouting using a detergent solution such as “Spic n Span®”, Trisodium Phosphate, “Ajax®”, “Comet®”, or non-abrasive cleaner to remove any haze or residue. Do not allow grout film to remain on surface for more than 24 hours.

E. Metal Edge Trim Strips: Verify in field, height dimension of trim product in relation to thickness of the tile and/or mortar bed, and report to the General Contractor, in writing, any discrepancy detrimental to the proper installation of the product. Install specified metal edge trim angles where shown, and as detailed on the Drawings.

1. Installation: Press the perforated anchoring leg of the trim strip into the tile adhesive and align.
Trowel tile adhesive over the anchoring leg. Surface of the tile shall level with the top of the trim (the trim shall not be higher than the surface of tile, rather slightly lower – approximately 1/32"). The joint between the tile and the trim (approximately 1/32" - 1/8") shall be filled completely with grout.

F. Floor Joint Sealant: Provide control joints in floor Work where Tile Work abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes and where changes occur in backing materials as detailed on the Drawings and/or required by field conditions.

3.05 MARBLE THRESHOLD INSTALLATIONS

A. Install thresholds in white dry set mortar (with latex system) similar to setting of floor tile, and point joints between marble and tile flush.

3.06 COUNTERTOP INSTALLATION

A. Adhesive Applications: Provide Epoxy Adhesive product as specified herein for installation of granite on substrate, as indicated on the Drawings.

1. Preparation:

   a. Before using, store resins at room temperature (70°F+21°C+) for 24 hours to ensure ease of mixing. All surfaces must be sound, clean, free of oil, waxes, or other bond inhibiting contaminants.

   b. Clean and grind back of granite at areas to receive the Epoxy Adhesive spots using a mechanical wheel grinder with a diamond wheel/blade. Remove dust with a stiff brush, wipe entire surface. Using a damp sponge (not wet), wipe the granite to remove any particles or remaining dust to ensure a clean direct bond and that all ground material is removed. Wipe dry with a clean cloth, then apply Epoxy Adhesive. NOTE: Epoxy Adhesive should not be applied to saturated or wet granite. If wetness or dampness is observed inside the granite after grinding off the top layer, the granite is saturated and must be allowed to dry out.

2. Mixing: Combine equal volumes of Epoxy Adhesive Part A and Part B (1:1 mix ratio by volume). Mix until uniform in color; no swirls. Small quantities may be mixed with a putty knife or margin trowel. Larger quantities may be mixed with an electric drill mixer (low speed).

3. Application:

   a. Apply dabs evenly distributed on back of the granite as recommended by manufacturer. Finished dab thickness must be a minimum of 1/8" (3mm).

   b. After installation of Epoxy Adhesive onto the substrate, install onto substrate and adjust for plumb and level.

4. Cleaning: Clean tools and Work while epoxy is fresh, using warm water. Detergent or soap may be added to the water for easier cleaning.

3.07 IMPERFECT TILE WORK

A. When directed by the Architect, and prior to final acceptance of the Work, remove all broken, chipped, loose or otherwise unsatisfactory installed Tile and Countertop Work.

B. Patch and restore imperfect tile materials and workmanship to good condition satisfactory to the Architect and/or Owner.

3.08 PROTECTION

A. Protect installed Work from damage at all times during the progress of the Work.

B. Properly protect all finished Work from damage that is in place at the time this Work is being done. Tile Contractor shall be responsible, and will be required to pay for all damage to other Work caused by the Contractor's workmen.

C. Protective covering shall be non-staining multi-purpose building paper with compatible seam tape. Product shall be such as "SealTight® Red Rosin Paper" as manufactured by W.R. Meadows, Inc., 300 Industrial Drive, P.O. Box 338, Hampshire, IL 60140-0338, (800)342-5976, (847)214-2100; www.wrmeadows.com, or comparable equivalent product subject to review by the Architect.

3.09 CLEANING

A. During progress of the Work, keep the premises free of all debris and waste materials resulting from the Work of this section. Remove all debris and rubbish from the site. Upon completion and before final acceptance of the Work, remove all debris, rubbish, unused materials, tools, and equipment from the site.

B. When directed by the Architect, after the Work of other trades is substantially completed, remove and dispose of protective coverings and thoroughly clean all Work installed under this section. Use of acid will not be permitted. Use clean water in initial cleaning. Remove all stains, excessive mortar, etc.

C. Cleaner shall be a neutral, general, all-purpose cleaner free of acids, alkalies and abrasives such as one of the following:

1. Mira Clean #1 by Miracle Sealants Company, 12318 Lower Azusa Road, Arcadia, CA 91006-5872, (800)350-1901 or (626)443-6433.

    a. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

2. Super Shine-All® by Hillyard, Inc., 302 North 4th. Street, P.O. Box 909, St. Joseph, MO, 64501, (816)233-1321 or (800)365-1555.

    a. Volatile Organic Compounds (VOC) Content: Paint and coatings product specified herein shall have a VOC content of 65 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

D. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 09 51 13
ACOUSTICAL PANEL CEILINGS

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

A. Section Includes:

1. Acoustical ceiling panels.

2. Exposed grid suspension system.

3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications:

1. Section 09290 - Gypsum Wallboard

2. Division 15 Sections - Mechanical Work

3. Division 16 Sections - Electrical Work

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

7. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

8. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.

9. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.

10. ASTM E 1264 Classification for Acoustical Ceiling Products.

11. ASTM E 1477 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

12. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

13. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material.

14. ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"

1.4 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner’s Representative and the General Contractor for review.

C. Submittals (where applicable):

1. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

D. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.

E. Shop Drawings: Layout and details of acoustical ceilings. Show locations of items which are to be coordinated with, or supported by the ceilings.

F. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

G. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.

a. Flame Spread: 25 or less

b. Smoke Developed: 50 or less

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.7 PROJECT CONDITIONS

A. Space Enclosure:

1. All ceiling products and suspension systems must be installed and maintained in accordance with Armstrong written installation instructions for that product in effect at the time of installation and best industry practice. Prior to installation, the ceiling product must be kept clean and dry, in an environment that is between 32°F (0°C) and 120°F (49°C) and not subject to Abnormal Conditions. Abnormal conditions include exposure to chemical fumes, vibrations, moisture from conditions such as building leaks or condensation, excessive humidity, or excessive dirt or dust buildup.

B. HumiGuard Plus Ceilings:

1. Installation of the products shall be carried out where the temperature is between 32°F (0° C) and 120°F (49° C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry. The ceilings must be maintained to avoid excessive dirt or dust buildup that would provide a medium for microbial growth on ceiling panels. Microbial protection does not extend beyond the treated surface as received from the factory, and does not protect other materials that contact the treated surface such as supported insulation materials.

1.8 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:

1. Acoustical Panels: Sagging and warping as a result of defects in materials or factory workmanship.

2. Grid System: Rusting and manufacturer's defects

3. Acoustical Panels with BioBlock Plus or designated as inherently resistive to the growth of micro-organisms installed with Armstrong suspension systems: Visible sag and will resist the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.

B. Warranty Period Humiguard:

1. Acoustical panels: Ten (10) years from date of substantial completion.

2. Grid: Ten (10) years from date of substantial completion.

3. Acoustical panels and grid systems with HumiGuard Plus or HumiGuard Max performance supplied by one source manufacturer is thirty (30) years from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.9 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.

2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2-PRODUCTS

2.1 SUBSTITUTIONS:

A. Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.2 MANUFACTURERS

A. Ceiling Panels:

1. Armstrong World Industries, Inc.

2.3 ACOUSTICAL CEILING UNITS

A. Acoustical Panels Type ACT-1: Armstrong Ceiling Systems Ultima-1912

1. Material: Mineral Fiber

2. Texture: Fine

3. Color: White

4. Size: 24in X 24in X 9/16"

5. Edge Profile: Beveled Tegular in White.

6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton, 0.50.

7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton, 35

8. Emissions Testing: Section 01350 Protocol, < 13.5 ppb of formaldehyde when used under typical conditions required by ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"

9. Flame Spread: ASTM E 1264; Class A (UL)

10. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.90.

11. Dimensional Stability: HumiGuard Plus - Temperature is between 32°F (0° C) and 120°F (49° C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry.

12. Antimicrobial Protection: BioBlock+ Plus - Resistance against the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.

13. Acceptable Product: Fine Fissured as manufactured by Armstrong World Industries.

2.4 SUSPENSION SYSTEMS

A. Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized (galvanized steel, aluminum, or stainless steel) as per ASTM A 653. Main beams and cross tees are double-web steel construction with 9/16” IN type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel (aluminum or stainless steel) in baked polyester paint. Main beams and cross tees shall have rotary stitching (exception: extruded aluminum or stainless steel).

1. Structural Classification: ASTM C 635 HD.

2. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.

3. Acceptable Product: Armstrong Suprafine XL 9/16” Exposed Tee- 7500 Grid Suspended System manufactured by Armstrong World Industries, Inc.

4. Shadow Molding: #7873.

B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least time three design load, but not less than 12 gauge.

D. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

E. Accessories

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations. (Exception: HumiGuard Max Ceilings)

B. Refer to Section 01 31 00 – Project Management & Coordination

C. Refer to Section 01 73 00 - Execution

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 INSTALLATION

A. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

B. Suspend main beam from overhead construction with hanger wires spaced 4-0 on center along the length of the main runner. Install hanger wires plumb and straight.

C. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

D. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

E. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.4 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage.

1. Ceiling Touch-Up Paint, (Item #5760, 8oz. bottles) (Item #5761, quart size cans), "global white" latex paint should be used to hide minor scratches and nicks in the surface and to cover field tegularized edges that are exposed to view.

C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 13
RESILIENT BASES AND ACCESSORIES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, and services necessary for Resilient Bases and Accessory Work indicated on the Drawings and specified herein. Work includes, but is not limited to the following:

1. Johnsonite Vinyl Transition Strips- (Refer to plans for color and location.)

2. Johnsonite Traditional Rubber Wall Base- ASTM F-1861, Type TP, 4” in height (120’ coil) Straight and cove. (Refer to plans for color and location.)

3. Armstrong Traditional Vinyl Base, Straight and cove. (Refer to plans for color and location.)

4. Nora Systems Wall Base, Straight and cove (Refer to plans for color and location.)

B. Color Selections (Refer to plans for color and location.)

C. Room Finish Schedule: Refer to the Drawings.

D. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Cast-in-Place Concrete - Section 03 30 00.

2. Rough Carpentry - Section 06 10 00.

3. Tile Work - Section 09 31 00.

4. Resilient Tile Flooring - Section 09 65 19.

1.02 QUALITY ASSURANCE

A. General: All material incorporated in the Work shall be subject to the Architect’s and Owner’s review. Methods of preparation, construction, and installation shall be in

accordance with manufacturer's printed specifications, unless otherwise directed by the Owner's Representative.

B. Unacceptable Materials: Material containing asbestos fibers are prohibited.

1.03 SUBMITTALS

A. General: Submit Product Data and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

C. Samples: Submit Samples of all materials for approval PRIOR to installation. Installed materials shall match approved Samples.

1. Submit the following Samples of each type, color and pattern required:

a. Accessories: 12" long Samples of items such as reducer strips, transition strips, and wall bases.

1.04 DELIVERY AND STORAGE

A. Delivery: Deliver only approved materials to the site in original boxes, crates, wrappings, clearly labeled with pertinent information to facilitate checking.

B. Storage: Store the materials at the site off the ground and in properly protected dry storage facilities, until ready for use. Damaged materials will not be acceptable, and shall be removed from the site.

C. Material Shelf Life: Do not retain material at the jobsite which has exceeded the shelf life recommended by the manufacturer.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.05 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expenses any imperfections which may develop during the period specified, and damage to other Work caused by imperfections or repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

1.06 EXTRA MATERIAL

A. General: At completion of the Work, deliver to Owner's Representative, additional replacement materials, in unopened boxes, sealed, and clearly labeled for maintenance purposes, in the following amounts:

1. Rubber Wall Bases: Thirty-two (32) lineal feet of each base type, size and color installed. Bases shall be of equal lengths not less than 4'-0".

PART 2 - PRODUCTS

2.01 A. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 MATERIALS

A. Transition Strips: Johnsonite Brand, or Armstrong Brand (high recycle content)

1. Colors: To match floor color as indicated on drawings.

B. Rubber Wall Bases Types:

1. Johnsonite Vinyl Transition Strips- (Refer to plans for color and location.)

2. Johnsonite Traditional Rubber Wall Base- ASTM F-1861, Type TP, 4" in height (120' coil) Straight and cove. (Refer to plans for color and location)

3. Armstrong Traditional Vinyl Base, Straight and cove. (Refer to plans for color and location.) Colors: As specified on the Drawings.

4. Nora Systems Wall Base, Straight and cove (Refer to plans for color and location.) Colors: As specified on the Drawings.

4. Provide pre-molded outside corner base units where required by Drawings or Project conditions.

C. Patching Compound: Fast patch compound brand name product of type recommended by the manufacturer of the resilient flooring material.

D. Adhesives: Cutback or clear thin spread type products recommended by the manufacturer of resilient flooring materials. Waterproof adhesives shall be used without adulteration. Floor tile adhesive shall not be used for wall bases, and wall base adhesive shall not be used for Floor Tile Work.

1. Volatile Organic Compounds (VOC) Content: Adhesives product specified herein shall have a VOC content of 50 grams/liter or less when calculated according to 40 CFR 59, subpart D (EPA method 24).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 INSPECTION AND PREPARATION

A. Inspection: Carefully inspect all surfaces upon which resilient flooring materials are to be applied. Notify the General Contractor for correction of any defects. Starting Work shall imply acceptance of the job conditions, and an unsatisfactory surface condition for the installation of the materials will not be considered valid in waiving any portion of the warranty.

1. Concrete floors to receive resilient flooring materials shall be smooth and of uniform steel trowel finish, free of curing or sealing compounds.

B. Preparation: Resilient bases and accessories shall not be laid on uncured or damp concrete. All concrete surfaces receiving resilient flooring materials shall be tested for dampness prior to installation of the flooring material. The following test may be used, or alternate methods as recommended by the resilient flooring manufacturer may be substituted.

1. Test Method for Dampness: Brush on floor primer in several areas approximately 3' x 3', preferably in area least subject to drying conditions. If after twenty-four (24) hours the primer can be scraped or peeled from the surface, the surface is unsuitable for installation of the resilient flooring material. Allow surface to dry further; retest until primer is well bonded to the surface, whereupon installation may proceed.

2. Concrete Floor Preparation: Concrete subflooring to receive resilient flooring materials shall be prepared in accordance with the manufacturer’s printed instructions and recommendations.

3.02 INSTALLATION

A. General: Install all resilient flooring materials specified herein and as indicated on the Drawings in accordance with the manufacturer’s printed specifications.

B. Vinyl Transition Strips: Provide transition strips as required by Drawings and/or field conditions.

C. Wall Bases: Install pre-molded wall bases including external and internal corners, coped neat and sharp.

1. Carpeted Areas: Coordinate Work with Carpeting Contractor for wall bases required in carpeted areas.

2. Prefabricated Cabinet Toe Boards: Install wall bases for exposed toe bases of prefabricated base cabinets.

D. Bonding Assurance: After installation, floors shall be rolled with heavy roller as recommended by the manufacturer to insure proper bond. Roller surface shall be such as not to damage or otherwise mar finish surfaces of resilient flooring.

3.03 CLEANING PROTECTION

A. General: Soon after installation of resilient bases and accessories, wipe-off all surplus adhesive and leave surfaces clean and free of surface marks or blemishes. All Work shall be thoroughly cleaned at time of completion, at the final completion of the building areas, and prior to occupancy when directed by the Architect.

B. Washing: Resilient flooring materials shall not be washed until time period recommended by resilient flooring materials manufacturer has elapsed, to allow materials to become well-sealed in adhesive.

C. Cleaning, Rinsing, and Sweeping: Clean and rinse all resilient bases and accessories with 140°F. water, and dry. Sweep clean with untreated yarn broom.

D. Protection: Protect all traffic areas of resilient flooring with undyed, untreated building paper.

3.04 DAMAGED WORK

A. All damaged or Defective Work shall be replaced. All other Work which becomes damaged in replacing Defective Work shall be replaced by Resilient Flooring Materials Contractor. Patched Work will not be accepted.

3.05 CLEAN-UP

A. During progress of the Work the premises shall be kept free of all debris and waste materials resulting from the Work of this section. All debris and rubbish shall be removed from the site. Upon completion of Work and before final acceptance of the Work, all debris, rubbish, unused materials, tools, and equipment shall be removed from the site.

B. Waste Management: Collect field generated construction waste created during construction or final.

END OF SECTION

SECTION 09 81 00
ACOUSTIC INSULATION

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PAER 1 GENERAL

1.01 SUMMARY

A. Section Includes: Formaldehyde-free™ fiberglass Sound control insulation.
Related Sections: The following items of related Work will be provided under other sections of the Specifications:

1. Division 7 Section: Roof Deck Insulation.

2. Division 7 Section: Joint Sealants.

3. Division 9 Section: Gypsum Board.

4. Division 9 Section: Acoustical Ceilings.

5. Division 15 Section: Mechanical: Duct insulation, Equipment insulation And Pipe insulation.

1.02 REFERENCES

A. ASTM International:

1. ASTM C165 Standard Test Method for Measuring Compressive Properties of Thermal Insulations.

2. ASTM C356 Standard Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat.

3. ASTM C411 Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

4. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

5. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

6. ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

7. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

8. ASTM C764 Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation.

9. ASTM C1014 Standard Specification for Spray-Applied Mineral Fiber Thermal and Sound Absorbing Insulation.

10. ASTM C1015 Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation.

11. ASTM C1104 Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

12. ASTM C1149 Standard Specification for Self-Supported Spray Applied Cellulosic Thermal Insulation

13. ASTM C1304 Standard Test Method for Assessing the Odor Emission of Thermal Insulation Materials.

14. ASTM C1320 Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

15. ASTM C1338 Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

16. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

17. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

18. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.

19. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.

20. ASTM E136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

21. ASTM E736 Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

22. ASTM E759 Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.

23. ASTM E970 Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Provide batt Insulation that have been manufactured, fabricated and installed to the following criteria:

1. Surface Burning Characteristics, Unfaced (ASTM E84): Flamespread index 25, smoke developed 50.

2. Combustibility (ASTM E136): Noncombustible.

3. Formaldehyde Content: Free of formaldehyde.

4. Assembly Fire Resistance Rating (ASTM E119): As shown in dwgs.

5. Assembly Sound Transmission Rating (ASTM E90): Refer product specifications.

6. Sound Absorption (ASTM C423): Refer product specifications.

7. Thermal Performance (ASTM C518): R11

1.04 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner’s Representative and the General Contractor for review.

C General: Submit listed submittals in accordance with provisions of Section 01300 Administrative Requirements.

D. Product Data: Submit manufacturer’s product data and installation instructions, including manufacturer’s SPEC-DATA® sheets.

E. Samples: Submit manufacturer’s standard selection and verification samples.

F. Quality Assurance/Control Submittals: Submit the following:

1. Test Reports: Upon request, submit [Fire] [Sound] And [Thermal] test reports from recognized test laboratories.

2. Certificates: Submit manufacturer's certificate that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Obtain each type of building insulation through a single source.

B. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity.

C. Pre-installation Meetings: Refer Division One Specifications.

1.06 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirement Section.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS:

A. Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 FORMALDEHYDE-FREE™™ BUILDING INSULATION

A. Manufacturer: Johns Manville.

1. Contact: 717 17th Street 80202; PO Box 5108, Denver, CO 80217-5108; Telephone: (800) 654-3103; Fax: (303) 978-2318; E-mail: pic@jm.com; website: www.specJM.com.

B. Proprietary Products/Systems: Building insulation, including the following:

1. JM Formaldehyde-free™ ComfortTherm® Poly-Encapsulated Batts:

a. Thermal Resistance (R-Value) (ASTM C518): R-11

b. Combustion Characteristics (ASTM E136): Pass.

c. Critical Radiant Flux (ASTM E970): Greater than 0.11 Btu/ft^2 × s (0.12 W/cm^2).

d. Water Vapor Permeance (ASTM E96): 0.5 perm (30 ng/Pa × s × m^2).

e. Water Vapor Sorption (ASTM C1104): 5% or less by weight.

f. Odor Emission (ASTM C1304): Pass.

g. Corrosiveness (ASTM C665, 13.8): Pass.

h. Fungi Resistance (ASTM C1338): Pass.

i. Recycled Content: Certified by Scientific Certification Systems to contain minimum of 20% post-consumer and 5% pre-consumer recycled glass product, on average of manufacturer's products.

j. Prove through documentation that product passes CIWMB Section 01350 for indoor air quality.

k. Thickness: 3 ½ "

l. Flamespread (ASTM E84): 25, maximum.

m. Smoke Developed (ASTM E84): 50, maximum.

n. Material Standard: ASTM C665, Type II, Class A (membrane-faced surface with a flamespread of 25 or less), Category 1 (membrane is a vapor barrier).

2.03 ACCESSORIES

A. Tape: Self-adhesive vapor retarder tape with flame spread index of 25 or less, smoke developed index of 50 or less.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with the instructions and recommendations of the building insulation manufacturer.

3.02 EXAMINATION

A. Site Verification of Conditions:

1. Verify that site conditions are acceptable for installation of building insulation.

2. Do not proceed with installation of building insulation until unacceptable conditions are corrected.

B. Refer to Section 01 31 00 – Project Management & Coordination

C. Refer to Section 01 73 00 – Execution

3.03 PREPARATION

A. Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

3.04 INSTALLATION

A. General: Comply with insulation manufacturer's written instructions applicable to products and application indicated.

1. Install insulation that is undamaged, dry and unsoiled and that has not been left exposed at any time to ice and snow.

2. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation.

3. Water Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

4. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

B. Installation of General Building Insulation:

1. Seal joints between closed-cell (non-breathing) insulation units by applying adhesive, mastic or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic or sealant as recommended by insulation manufacturer.

2. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

    a. Tape ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

3. Install glass-fiber blankets in cavities formed by framing members according to the following requirements:

    a. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

    b. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

    c. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

4. Wood-Framed Construction: Install mineral-fiber blankets in accordance with ASTM C1320 and as follows:

    a. With faced blankets having stapling flanges, secure insulation by friction fit inset or face stapling flanges to sides of framing members.

    b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to produce airtight installation after concealing finish material is in place.

5. Acoustical Insulation Installation: Install insulation where indicated in sound rated assemblies. Maintain acoustical rating of assembly.

6. Board Insulation Installation: Install insulation where indicated:

    a. Cut and friction fit insulation between vertical or Z-shaped framing.

b. Alternatively install insulation on impaling pins or with suitable adhesives.

c. Place pins 3 inches - 5 inches (76 - 127 mm) from edges of insulation.

7. Loose-Fill Insulation: Place loose-fill insulation into spaces and onto surfaces as shown, by machine blowing to comply with ASTM C1015. Level horizontal applications to uniform thickness as indicated. Hold insulation back from air vents, flues and heat-generating appliances.

E. Installation of Vapor Retarders:

1. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

2. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor retarder manufacturer.

3. Seal joints caused by pipes, conduits, electrical boxes and similar items penetrating vapor retarders with vapor retarder tape to create an airtight seal between penetrating objects and vapor retarder.

4. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor retarder tape or another layer of vapor retarder.

3.05 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site. Repair damage to installed products prior to installation of finish materials.

3.06 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 09 90 00
PAINTS AND COATINGS

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.

B. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available. Sherwin Williams Coatings listed at the end of this specification where used to establish the level of quality of the coating systems. The coating manufacturer shall match the colors identified in the finish schedule.

1. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

C. Painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, and labels.

1. Pre-finished items not to be painted include the following factory-finished components:

a. Acoustic materials.

b. Finished mechanical and electrical equipment.

c. Light fixtures.

d. Switchgear.

e. Distribution cabinets.

f. Plastic laminate wood doors.

g. Wood veneer doors

h. Metal lockers.

i. Plastic laminate covered architectural casework.

j. Wood veneer woodwork and casework.

k. Metal flashings.

l. Curtain wall system.

2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:

a. Furred areas.

b. Pipe spaces.

c. Ceiling plenums, with the following exception:

3. Finished metal surfaces not to be painted include:

a. Anodized aluminum.

b. Stainless steel.

c. Chromium plate.

d. Copper.

e. Bronze or brass.

4. Operating parts not to be painted include moving parts of operating equipment such as the following:

a. Valve and damper operators.

b. Linkages.

c. Sensing devices.

d. Motor and fan shafts.

5. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.02 RELATED SECTIONS: The following items of related Work will be provided under other sections of the Specifications:

A. Section 05 12 0 - Structural Steel.

B Section 05 21 00 - Steel Joist and Joists Girders: Shop Primed Items.

C. Section 05 50 00 - Miscellaneous Metal Work: Shop Primed Items.

D Section 22 05 53 - Identification for Plumbing Piping and Equipment.

E. Section 23 05 53 - Identification for HVAC Piping and Equipment.

F. Section 26 05 53 - Identification for Electrical Systems.

G. Section 27 05 53 - Identification for Communication Systems.

H. Section 06 20 00 - Finish Carpentry.

1.03 REFERENCES

A. SSPC-SP 1 - Solvent Cleaning

B. SSPC-SP 2 - Hand Tool Cleaning

C. SSPC-SP 3 - Power Tool Cleaning

D. SSPC-SP 13 / Nace No. 6 Surface Preparation for Concrete

E. EPA-Method 24

F. GS-11, GC-03

1.04 SUBMITTALS

A. General: Submit Shop Drawings and Product Data to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Submit, in accordance with, Section 01 33 00 – Submittal Procedures.

C. Product Data: Manufacturer's technical information, label analysis, application instructions and MSDS sheets for each material proposed for use.

1. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.

2. Provide Material Safety and Data Sheets on each product specified.

D. Samples: Upon selection of colors by the architect, submit samples for Architect's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.

1. On 12" x 12" hardboard, provide one sample of each paint color listed in the color schedule, with texture to simulate actual conditions. Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved. Samples shall be steeped to show primer, first coat, and second coat.

2. On actual wood surfaces, provide two 4" x 8" samples of stained wood finish.

3. On actual wall surfaces and other exterior and interior building components, duplicate painted finishes of prepared samples when requested by Architect. On at least 100 sq. ft. of surface as directed, provide full-coat finish samples until required sheen, color and texture is obtained; simulate finished lighting conditions for review of in-place work.

4. Do not proceed with painting until materials and finishes are approved by Architect.

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect of problems anticipated using the materials specified.

C. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude equal products of other manufacturers.

2. Federal Specifications establish a minimum quality level for paint materials, except where other product identification is used. Provide written certification from the manufacturer that materials provided meet or exceed these criteria.

3. Products that comply with qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to the Architect. Furnish material data and manufacturer's certificate of performance to Architect for proposed substitutions.

D. Interior coating type: Provide interior painting systems which are VOC compliant as per Green Seal Environmental Standard GS-11 for interior paint VOC thresholds:

1. Non-flat: VOC not more than 50 g/L.

2. Flat: VOC not more than 50 g/L.

E. Interior/Exterior coatings type: Provide interior/exterior coating systems which are VOC compliant as per Rule 1168 of the South Coast Air Quality Management District for coatings, primers, stains:

1. Primers, Sealers and Undercoaters: VOC not more than 200 g/L.

2. Clear Wood Finishes:

a. Varnish: VOC not more than 350 g/L.

b. Sanding Sealers: VOC not more than 350 g/L.

c. Lacquers: VOC not more than 275 g/L.

3. Stains, interior: VOC not more than 250 g/L.

4. Floor coatings: VOC not more than 100 g/L.

F. Exterior coating type: Provide exterior painting systems which are VOC compliant as per Green Seal Environmental Standard GS-11 for exterior paint VOC thresholds:

1. Non-flat: VOC not more than 200 g/L.

2. Flat: VOC not more than 100 g/L.

G. Interior/Exterior anti-corrosive and anti-rust coating types for ferrous metals: Provide interior/exterior painting systems for ferrous metals which are VOC compliant as per Green Seal Environmental Standard GC-03 for interior/exterior paint VOC thresholds:

1. Gloss: VOC not more than 250 g/L.

2. Semi-Gloss: VOC not more than 250 g/L.

3. Flat: VOC not more than 250 g/L.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.

2. Product description (generic classification or binder type).

3. Federal Specification number, if applicable.

4. Manufacturer's stock number and date of manufacture.

5. Contents by volume, for pigment and vehicle constituents.

6. Thinning instructions.

7. Application instructions.

8. Color name and number.

9. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. 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.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.07 JOB CONDITIONS

A. Section 01 60 00 – Product Requirements.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint manufacturer.

C. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F (10 deg C) and 90 deg F (32 deg C).

D. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F (7 deg C) and 95 deg F (35 deg C).

E. Do not apply paint in snow, rain, fog, or mist, when the relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

F. Provide lighting level of 80 foot candle measured mid-height at substrate surface.

1.08 EXTRA MATERIAL

A. Provide one gallon of each different paint system, and color with manufacturers name and color clearly labeled on the top of each container.

1.09 PRE-PAINTING CONFERENCE

A. Prior to finish painting, exterior and interior, General Contractor shall schedule a "Pre-Painting Conference" to be attended by the Architect, Contractor, Painting Subcontractor and Manufacturer's Representative (Manufacturer's Rep. to attend when required for special finishes.)

B. Agenda to include submittal of color and finishes sample (RE: Article 1.04 "Submittals" and review of color schedule.

C. Contractor to record discussions of conference including agreements and/or disagreements and distribute a copy of record to each party in attendance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Coating Manufacturer:

1. Benjamin Moore.

a. Refer to "List of Finishes" located on the drawings for paint colors. Coating manufacturer shall computer match the colors selected.

B. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.

1. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Refer to Section 01 31 00 – Project Management & Coordination

C. Refer to Section 01 73 00 - Execution

3.02 PREPARATION

A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.

2. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

    a. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knob sealer before application of primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

    b. Prime, stain, or seal wood to be painted immediately upon delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.

    c. When transparent finish is required, backprime with spar varnish.

    d. Seal tops, bottoms, and cutouts of wood doors with a heavy coat of varnish or sealer immediately upon delivery.

3. Ferrous Metals: Clean non-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 recommendations of the Steel Structures Painting Council.

    a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.

4. Galvanized Surfaces: Allow to weather a minimum of 6 months prior to coating. Clean per SSPC-SP1 using detergent and water or a degreasing cleaner, then prime as required. When weathering is not possible or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP7 as necessary to remove these treatments.

5. Aluminum: Remove all oil, grease, dirt, oxide and other foreign material by solvent cleaning per SSPC-SP1, solvent cleaning.

6. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt grease, oils, and release agents.

Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.

b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

c. Cementitious materials shall have cured for a minimum of 30 days prior to painting.

d. Damaged areas shall be repaired using appropriate materials.

7. Drywall: Surface must be clean and dry. All nail or screw heads must be set and spackled. Joints must be taped and covered with joint compound. Spackled fastener heads and tape joints must be sanded smooth and all dust removed prior to painting.

8. Previously coated surfaces: Remove all surface contamination such as oil, grease, loose paint, mill scale, dirt, rust, mold, mildew, mortar efflorescence and scalers. Glossy surfaces of old paint films shall be clean and dull before painting. Clean and dull surface either by washing with an abrasive cleaner, or by washing and sanding. Spot prime bare areas with appropriate primer. Check for compatibility by applying a test patch of the specified system, coating an area of 3 square feet. Allow to dry for one week before testing adhesion as per ASTM D3359. If coating is incompatible, prepare surface in conformance with ASTM D4259.

C. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.

1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and if necessary, strain material before using.

3. Use only thinners approved by the paint manufacturer, and only within recommended limits.

3.03 APPLICATION

A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Non-zinc coated architectural metals, steel doors and steel frames shall have all coatings spray applied. Brush application is not acceptable.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

1. Paint colors, surface treatments, and finishes are indicated in "schedules."

2. Provide finish coats that are compatible with primers used.

3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.

4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.

5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.

6. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.

7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

9. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.

10. Sand lightly between each succeeding enamel or varnish coat.

C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pre-treated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.

F. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears to assure a finish coat with no burn through or other defects due to insufficient sealing.

G. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

I. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

J. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

K. Stripple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 CLEANING

A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

3.05 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

B. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 EXTERIOR PAINT SCHEDULE

A. General: Provide the following paint systems for the various substrates, as indicated:

B. Metals:

1. Ferrous Metal (Anti-Corrosive coating):

a. Semi-Gloss Acrylic Latex: 2 finish coats over primer on properly prepared surface:

b. Primer:

1) Universal Water Based Primer

c. First and Second Coats:

1) High Performance Acrylic- spray applied.

d. Third Coat:

1) Acrylic Clear Coat

2. Zinc-Coated Metal:

   a. Gloss Latex: 2 finish coats over primer on properly prepared surfaces.

   b. Primer:

      1) Universal Water Based Primer

   c. First and Second Coats:

      1) Industrial 0 VOC Acrylic Semi-Gloss,

3. Stucco Surfaces and EIFS Substrates:

   a. Primer: 2 finish coats over primer on properly prepared surfaces.

      1) Concrete and Masonry Primer

   b. First and Second Coats:

      1) High Build Elastomeric

4. Bollards

   a. Primer:

      1) Universal Primer

   b. First and Second Coats:

      1) Industrial Urethane Alkyd (Safety Yellow)

5. Parking Striping/Curb Ramps

    a. One Coat.

3.07 INTERIOR PAINT SCHEDULE

A. General: Provide the following paint systems for the various substrates as indicated.

B. Drywall (walls and ceiling): Furnish sample on 2'x2' piece of drywall for architect to approve prior to application.

1. Gypsum Drywall Systems:

    a. Semi-Gloss Acrylic Enamel: 2 finish coats over primer on properly prepared surface:

    b. Texture

        1) USG Sheetrock Brand Wall and Ceiling Spray Texture (Multipurpose) (fine orange peel).

        2) Texture Additive: Sheetrock Brand First Coat: Add at a rate of 1 gal. per bag of texture-substitute for 1 gal. of water.
        VOC: 2 g/L.

    c. Primer:

        Zero VOC Primer

    a. First and Second Coats:

1) Zero VOC Acrylic Semi-Gloss

2. Gypsum Drywall Systems:

    a. Egg-Shell Acrylic Enamel: 2 finish coats over primer on properly prepared surface.

    b. Texture

        1) USG Sheetrock Brand Wall and Ceiling Spray Texture (Multipurpose) (fine orange peel).

2) Texture Additive: Sheetrock Brand First Coat: Add at a rate of 1 gal. per bag of texture-substitute for 1 gal. of water.
VOC: 2 g/L.

c. Primer:

1) Zero VOC Primer

b. First and Second Coats:

1) Zero VOC Acrylic Semi-Gloss

C. Metals

1. Ferrous Metals:

a. Semi-Gloss Acrylic Enamel: 2 finish coats over primer on properly prepared surface.

b. Primer:

1) Universal Water Based

c. First and Second Coats:

1) Industrial 0 VOC Acrylic Semi-Gloss

2. Zinc Coated Metals:

a. Semi-Gloss Acrylic Enamel 2 coats on properly prepared surface.

b. Primer

1) Universal Water Based Primer

c. First and Second Coats:

1) Acrylic Semi-Gloss

3. Ferrous Metal Handrails and Guardrails:

a. Handrails:

1) Semi-Gloss Acrylic Enamel: 2 finish coats over primer on properly prepared surface.

2) Primer:

a) Universal Water Based Primer

3) First and Second Coats:

a) Industrial 0 VOC Acrylic Semi-Gloss

D. Wood (Trim) Painted

1. Semi-Gloss Acrylic Enamel: 2 coats over primer on properly prepared surface: Verify all fasteners are set below the surface of the wood. Apply wood filler, compatible with paint, to all exposed indentations. Sand smooth.

2. Primer:

a. Premium Wood and Wall Primer

b. Sand prime coats with 220 grit sand paper.
VOC: 36 g/L < 200 g/L.

3. First and Second Coats:

a. Waterborne Acrylic Semi-Gloss

E. Wood (Trim) Clear wood finish:

1. Polyurethane, Satin: 2 coats. Verify all fasteners are set below the surface of the wood. Apply wood filler to all exposed indentations. Sand smooth.

2. First and Second Coats:

a. Wood Classics Waterborne Polyurethane Varnish.

F. Wood (Stained) with clear polyurethane varnish

1. Stain: One coat of Wood Finish.

2. First and Second Coats:

a. Waterbased Varnish.

G. Exposed Concrete Floors and Curbs in HVAC rooms:

1. Waterbased Urethane Finish: 2 coats over primer on properly prepared surface with anti-slip additive. Prepare concrete surfaces in accordance with SSPC-SP13/NACE 6.

2. Primer:
   a. Water Based Epoxy Primer

3. First and Second Coats:

   a. Water Based Urethane

   b. Anti-slip additive: Added to the coating.

H. Masonry

1. Concrete Masonry Units:

   a. Semi-Gloss Acrylic Enamel: 2 finish coats over primer on properly prepared surface:

   b. Primer:

      1) Block Filler

   c. First and Second Coats:

      1) Waterborne Acrylic Semi-Gloss

3.08 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 10 14 00
SIGNAGE

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, apparatus, tools, transportation, protection and services necessary for, and reasonably incidental to the proper execution and completion of all Signage Work, as indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Building Identification Signage.

2. Entrances Door Signage.

3. Interior-Room Identification Signage.

4. Barrier Free Signs.

5. Vinyl Reception Window Letters.

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Cast-In-Place Concrete Work - Section 03 30 00.

2. Unit Structural Masonry - Section 04 23 00.

3. Finish Carpentry - Section 06 20 00.

4. Aluminum Framed Entrance and Storefronts - Section 08 41 13.

6. Paints and Coatings - Section 09 90 00.

7. Toilet Compartments - Section 10 21 13.

1.02 REFERENCE SPECIFICATIONS, CODES, AND APPLICABLE STANDARDS

A. Requirements of Regulatory Agencies: Furnish all signs in accordance with the laws, codes, ordinances and regulations of the public authorities having jurisdiction, including Title III of The Americans with Disabilities Act (ADA), Public Law 101-336.

1.03 QUALITY ASSURANCE

A. General: All materials, articles, accessories incorporated in the Work shall be type and quality specified herein, and subject to the Architect's review. Methods of preparation, construction and installation of such materials, articles and accessories shall be strictly in accordance with the accepted standard practices, manufacturer's printed specifications and/or instructions, the Architect's Drawings and Specifications, and as directed by the Architect.

B. Single Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.

C. Design Criteria: The Drawings indicate size, profiles, dimensional requirements and graphics layout of signs and are based on the specific type and/or model indicated. Signs by other manufacturers may be considered provided that deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.04 SUBMITTALS

A. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner's Representative and the General Contractor for review.

B. General: Submit Shop Drawings, Product Data, and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

C. Shop Drawings: Prepare and submit fully detailed drawings of all items specified herein.

D. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.

E. Samples: Submit 4" x 4" color Samples on materials to be used for fabrication. Written approval shall be secured from the Architect. Installed materials shall match approved Samples.

1.05 MATERIAL DELIVERY AND STORAGE

A. Delivery: Deliver only acceptable materials to the site in original boxes, and wrappings, clearly labeled with all pertinent information to facilitate checking.

B. Storage: Materials shall be stored at the site off the ground and in properly protected dry storage facilities, until ready for use. Damaged materials will not be acceptable, and shall be removed from the site.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

PART 2 - PRODUCTS

2.01 Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

2.02 BUILDING IDENTIFICATION SIGNAGE

A. Manufacturer: Signage specified herein shall be as manufactured by Allen Markings, 1130 Elmwood Avenue, Kansas City, MO 64127, (816)842-0963, (800)825-0150; www.allendiv.com, or other comparable manufacturer and equivalent product subject to review by the Architect.

B. General: Provide complete and coordinated signage with maximum flexibility and use of manufacturer's standards. Design effect shall maintain overall continuity of color, letter style, and shape as specified herein.

C. Graphic System: Allenite-Architectural Sign Systems, "System 1700 - Vinyl Lettered Signs & Vinyl Letters", computer-cut, pressure sensitive and pre-spaced strips. System shall be forward or reverse cut as selected by the Architect.

1. Sign Address Numbers or Letters: 4" high (unless otherwise directed by local authorities), "Helvetica Medium" Style.

2. Colors: As selected by Owner and to comply with the Texas Accessibility Standards.

3. Mounting: Pressure sensitive material with manufacturer's adhesive.

4. Address Numbers: Suitable for mounting above building's aluminum front entrance doors.

D. Exterior Signs Required: Sign titles and quantities include, but are not necessarily limited to the following.

1. Building Fronts: Addresses as required by the Fire Marshall.
2. As noted on the drawings.

2.03 ALUMINUM/GLASS ENTRANCE DOOR SIGNAGE

A. Manufacturer: Allen Markings, 1130 Elmwood Avenue, Kansas City, MO 64127, (816)842-0963, (800)825-0150; www.allendiv.com, or other comparable manufacturer and equivalent products subject to review by the Architect.

B. Graphic System: Allenite-Architectural Sign Systems, “System 1700 - Vinyl Lettered Signs & Vinyl Letters”, computer-cut, pressure sensitive and pre-spaced strips.

C. Door Signage:

1. International Symbol of Accessibility Signs: 3" square, contrasting blue background and white graphics, with matte non-glare finish.

2. Egress Signage: Each storefront door sign shall have “Helvetica Medium Style” white letters not less than 1 inch high on a contrasting black background.
   a. Wording: Sign shall read “THIS DOOR MUST REMAIN UNLOCKED DURING NORMAL BUSINESS HOURS”.

2.04 INTERIOR-ROOM IDENTIFICATION SIGNAGE

A. Manufacturer: Signage specified herein shall be signs as manufactured by Innerface Architectural Signage, Inc., 5320 Webb Parkway, Lilburn, GA 30247, (770)921-5566, **www.interface-signage.com.**

B. Comparable Products: Manufacturers with comparable equivalent signage may be acceptable, subject to conformance with these Specifications and review by the Architect and/or Owner.

C. Sign Type: Signs shall be Plaque Modules, suitable for wall mounting or hung from the ceiling. Verify mounting condition and location with Tenant.

1. Construction: Signs shall have raised graphic symbols and letters and ADA compliant Grade 2 Braille as an integral part of the material. Signs shall be contrasting two-color, scratch resistant, non-static, fire-retardant, washable material with a non-glare matte finish surface, unframed, with finished edges and round corners.

2. Colors: Royal Blue background with White lettering. Color to be verified with Tenant.

3. Sizing: For “bidding purposes”, verify final size with Tenant.

4. Room Signs: 7" x 7", module 4.0 with insert.

5. Mounting: Factory prepared with 1/16" thick vinyl foam tape or mounting holes for use with mechanical fasteners, subject to review by the Architect and/or Owner. General area signs may be hung from ceiling as determined by Tenant.

D. Room Signs Required: Sign titles and quantities include, but are not necessarily limited to the following. Verify final number of signs and titles with the Tenant.

1. Break Room (1 required).

2. Storage (1 required).

3. Restroom (1 required)

3. Shower Room (1 required)

4. Tools Room (1 required)

E. Lettering Style: Raised 1/32 inch upper case Helvetica medium

F. Accessibility Requirements: Facilities and elements required to be identified as accessible shall include the International Symbol of Accessibility pictogram with verbal description, and Grade 2 Braille. Signage shall comply with applicable provisions of Title III of ADA, Article 4.30 within Appendix A to Part 36 of 28 CFR. Field area size shall be in accordance with governing code requirements for accessibility and use by persons with disabilities.

2.05 BARRIER FREE SIGNS

A. Manufacturer: Signage specified herein shall be as manufactured by Seton Identification Products, 20 Thompson Road, P.O. Box 819, Branford, CT 06405-0819, (800)571-2596 or (203)488-8059; www.seton.com.

B. Comparable Products: Comparable equivalent signage by the following company, or other comparable manufacturer's product may be acceptable, subject to conformance with these Specifications and the Architect's review.

1. Allen Markings, 1130 Elmwwod Avenue, Kansas City, MO 64127, (816)842-0963 or (800)825-0150; www.allendiv.com.

C. Decal Signs: Barrier free signs at toilet partitions designated for individuals with a disability shall be Seton "Handicap Symbol Decal", Item #35839, tear-resistant, self-adhesive vinyl single sided decal.

1. Graphics: International Symbol Accessibility sign shall have contrasting blue background and white graphics, with matte non-glare finish.

2. Size: 4" x 4".

2.06 VINYL LETTERED SIGNAGE

A. Manufacturer: Allen Markings, 1130 Elmwood Avenue, Kansas City, MO 64127, (816)842-0963, (800)825-0150; www.allendiv.com, or other comparable manufacturer and equivalent products subject to review by the Architect.
- Refer Interior Elevations for additional vinyl signage to be applied at the front door for Hours of Operation, Drop and Pick-up at Pharmacy, etc.

B. Graphic System: Allenite-Architectural Sign Systems, “System 1700 - Vinyl Lettered Signs & Vinyl Letters”, computer-cut, pressure sensitive adhesive and pre-spaced strips.

C. Front Doors:

1. Letters: 2" high, for Hours of Operation. Refer drawings. Coordinate color and locations with the tenant.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 INSTALLATION

A. General: Furnish and install products as shown on the Drawings and specified herein. Special attention shall be given to, but not necessarily limited to the following:

1. Exterior Building Identification Signage: Install signs as indicated and/or shown on the Drawings.

2. Aluminum/Glass Entrance Door Signage: All accessible public entrance doors shall be provided with “International Symbol of Accessibility Signs” and “Egress Signage” as specified herein.

a. International Symbol of Accessibility Signs: Graphics shall be readable from exterior side of door.

b. Egress Signage: Apply signage so that wording is readable from interior face side of storefront door.

c. Surface Conditions: Apply signage on clean surfaces, flat and smooth without ripples or air bubbles.

d. Compliance with Local Authorities: Signage shall be located as required by local authorities.

3. Interior-Room Identification Signage: Install signs as indicated and/or shown on the Drawings.

4. Barrier Free Signs: Install signs for toilet compartment/partition stall doors where indicated on the Drawings for individuals with a disability.

5. General Area Sign: Install signs in locations as directed by Tenant.

6. Vinyl Lettered Signage: Install numbers and letters in locations as directed by Tenant.

B. Accessory Materials: Provide all accessory materials required and necessary for complete and finished installations.

C. ADA Accessibility Guidelines: Signage required to be with accessible designation shall comply with “Mounting Location and Height” specified within the provisions of Article 4.30 of the ADA Accessibility Guidelines.

D. Protection: Protective covers provided by the manufacturer to protect the finishes shall not be removed until final cleaning.

3.03 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 10 28 13
TOILET ACCESSORIES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide Toilet Accessories Work as indicated on the Drawings and specified herein. Work includes, but is not necessarily limited to the following:

1. Grab Bars.
2. Toilet Paper Dispensers.
3. Framed Mirrors.
4. Sanitary Napkin/Tampon Dispensers.
5. Sanitary Napkin Disposals.
6. Soap Dispensers.
7. Paper Towel Dispenser and Waste Receptacle Units.
8. Toilet Seat Cover Dispensers.
9. Insulation Kits for Lavatories with Exposed Piping.
10. Mop Hangers/Hook.
11. Paper Tower Dispensers
12. Shower Curtain Rod
13. Shower Seat
14. Soap Dish
15. Towel Hook
16. Shower Curtain
17. Coat Hook with Bumper

B. Related Sections: The following items of related Work will be provided under other sections of the Specifications, as indicated:

1. Rough Carpentry - Section 06 10 00.

2. Finish Carpentry - Section 06 20 00.

3. Gypsum Wallboard - Section 09 29 00.

4. Thin-Set Tile Work - Section 09 31 00.

5. Toilet Partitions - Section 10 16 00.

1.02 REFERENCE SPECIFICATIONS, CODES, AND APPLICABLE STANDARDS

A. Requirements of Regulatory Agencies: Furnish toilet accessories in accordance with laws, codes, ordinances and regulations of the public authorities having jurisdiction, including Title III of The Americans With Disabilities Act (ADA), Public Law 101-336 and the Texas Accessibility Standards.

1.03 QUALITY ASSURANCE

A. Heavy Duty Construction: Provide where applicable, product and material accommodations with reinforcements suitable for obesity clinic patients weighing 400 pounds.

1.04 SUBMITTALS

A. General: Submit Shop Drawings, Product Data, and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

B. Shop Drawings: Submit fully detailed layout and setting drawings, illustrative plates or drawings, and Supplementary Shop Drawings of all items.

C. Samples: Submit 4" x 4" Samples of colors and/or finishes specified herein, for approval PRIOR to installation. Written approval shall be secured from the Architect, and installed materials shall match approved Samples.

1.05 MATERIAL DELIVERY AND STORAGE

A. Delivery: Deliver only acceptable materials to the site in original boxes, crates, and wrappings, clearly labeled with all pertinent information to facilitate checking.

B. Storage: Materials shall be stored at the site, off the ground in properly protected dry storage facilities, until ready for use. Damaged materials will not be acceptable, and shall be removed from the site.

C. Lead Time: When phenolic and plastic laminated products are specified, allow not less than six (6) weeks lead time.

D. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and any damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

B. Stainless Steel Framed Mirrors: In addition to the above warranty, the stainless steel framed mirror manufacturer shall provide industry standard of not less than a fifteen (15) year written guarantee against glass mirror silver spoilage.

PART 2 - PRODUCTS

2.01 TOILET ROOM ACCESSORIES - GENERAL

A. Manufacturer: Unless otherwise noted, items specified herein represent commercial quality products manufactured by the following manufacturer, and illustrate the type, function, size, operation, material, finish and constructions required.

1. Bobrick Washroom Equipment, Inc., 11611 Hart Street, North Hollywood, CA 91605-5882, (800)553-1600, (818)982-9600 or (818)764-1000; ww.bobrick.com.

B. Substitutions: Manufacturers with comparable equivalent products may be acceptable, subject to conformance with these Specifications, the requirements of the Drawings, and the Architect's review. Refer to Specification 01 25 00 – Substitution Procedures.

C. Material and Finish: Unless otherwise specified, all items shall be of Type 304 stainless steel with satin finish.

D. Supplementary Hardware: Furnish each item complete with non-corrosive fasteners, anchorage, trim, and back-up plates as required for securing to walls (masonry and/or drywall). Furnish all incidental parts.

E. Fasteners: Provide vandal-resistant fasteners wherever exposed fasteners are required.

F. Locks: Toilet room accessories equipped with tumbler locks shall be keyed alike with all other locked toilet room accessories, with the exception of coin boxes in vending equipment. All tumbler locks shall be fastened to accessories with lock nuts. Fastening locks to units with spring clips is not acceptable.

G. Product Identification Labels: Products shall have either a printed waterproof label or stamped nameplate indicating manufacturer's name and product model number. Identification labels shall not be on the exposed finish surface of the product.

2.02 TOILET ROOM ACCESSORIES

A. Grab Bars: BOBRICK 5806 (Refer to dwgs for length required)

B. Toilet Paper Dispensers: Bobrick model B2888

C. Wall mounted Framed Mirrors: Bobrick B-165 series (Refer to dwgs for required sizes).

D. Sanitary Napkin/Tampon Dispensers: Classic recessed napkin/tampon Bobrick model B3706 25.

E. Surface-mounted Sanitary Napkin Disposals: Bobrick Contura Series B-270

F. Soap Dispensers:

1. Automatic Countertop Mounted Foam Soap Dispenser: Bobrick Model B-828. Refer drawings for mounting heights.

G. Paper Towel Dispenser and Waste Receptacle Units. Refer drawings for mounting heights.

1. Recessed (Paper Towel and Waste) Convertible: Bobrick model B-3961.

2. Surface-mounted: Bobrick ClassicSeries model B-262.

H. Toilet Seat Cover Dispensers: All welded construction. Dispensers shall be suitable for dispensing standard single-fold or half-fold paper toilet seat covers from beveled opening.

1. Surface-Mounted Dispensers: Bobrick model B-221

I. Surface-Mounted Dryer: Refer Hand Dryer Spec.

J. Vertical Wall-Mounted Baby changing station: Bobrick model KB101-00.

K. Insulation Kits: Lavatories with exposed piping shall be provided with Protective Undersink Piping Covers, specified herein, complete with all accessories required, or comparable equivalent manufacturer's product, subject to review by the Architect.

1. Manufacturer: IPS® Corporation, 500 Distribution Parkway, Collierville, TN 38017, (800)888-8312 or (901)853-5001; www.truebro.com.

2. Undersink Protective Pipe Covers: ADA-compliant (Article 4.19.4), wheelchair accessible lavatory P-trap and angle valve assemblies shall be covered with molded vinyl, antimicrobial. TRUEBRO® - LAV GUARD® 2 E-Z Series waste and supply piping undersink pipe covers. Cover shall have internal trim feature for square and clean trimming, internal rib fasteners, and built-in, concealed fasteners (cable-tie fasteners shall not be permitted).

   a. Material: Soft, resilient molded vinyl.

   b. Nominal Wall: 1/8" constant with internal ribs.

   c. Trimming (E-Z Series): Internal E-Z Tear-To-Fit trim feature for installation without tools.

   d. Fasteners (E-Z Series): Internal E-Z Grip fasteners, reusable.

   e. Paintability: Material shall be paintable with latex paint where required by Drawings and/or field conditions to match adjacent material colors.

   f. Burning Characteristics: Self extinguished 0 sec (ATB) mm (AEB), in accordance with ASTM D635 - Standard Test Methodd for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

   g. Bacteria/Fungus Resistance: In accordance with ASTM G21 - Standard Practice for Determing Resistance of Synthethic Polymeric Materials to Fungi. Result: 0 growth.

   h. Color: Manufacturer's standard "China White", subject to approval by the Tenant, Architect and/or Owner.

3. Compatibility: Contractor shall coordinate with Plumbing Contractor for compatible complete design kit series required to fit piping assemblies.

L. Mop Hangers/Hook: Bobrick Stainless steel Mop-Broom Holder Model No. B-223.

M. Paper Tower Dispensers (for break room area and kitchen): Bobrick Classic Series Surface Mounted Paper Towel Dispenser, Model No. B-262

N. Soap Dish: Bobrick Heavy Duty Soap Dish Model o. B-4380

O. Coat Hook with Bumper: Bobrick Model No. B-212

P. Towel Pin: Bright-polished stainless steel Towel Pin Bobrick B-677.

2.03 CUSTODIAL ACCESSORIES

A. Mop Hangers: Mop service basin optional equipment shall be Model No. 889-CC Mop Bracket, 24" long x 3" wide, 16 gauge, type 302 stainless steel with three (3) rubber tool grips, provided with stainless steel machine and/or wood screws as required by field conditions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 INSPECTION

A. Check wall openings for dimensions, plumbness of blocking or frames that would affect installation of recessed accessories. For surface mounted accessories check condition of wall and confirm installation of backing within wall.

B. Verify spacing of plumbing fixtures and toilet compartments that affect installation of toilet room accessories.

3.03 INSTALLATION

A. General:

1. Comply with ADA and code requirements for facilities for individuals with a disability. Should governing code requirements differ from any specified herein, the more stringent requirement shall be met.

2. Protective covers installed by manufacturers to protect the finishes, shall not be removed until final cleaning.

B. Locations and Methods of Installation: Install accessories at locations and heights indicated on the Drawings, straight, plumb and level and in accordance with manufacturer's installation instructions. Install items with non-corrosive anchoring devices. Installation methods shall conform to manufacturer's recommendations for backing and proper support. Conceal evidence of drilling, cutting, and fitting to room finish. Fit flanges of accessories snugly to wall surfaces.

C. Grab Bars: Mount grab bars to walls and partitions with supplied flanges and fasteners. Installed grab bars shall be anchored so as to withstand a force of not less than 300 pounds for five (5) minutes in any direction.

D. Lavatory Insulation Kits: Install on exposed piping at each lavatory.

3.04 FIELD INSPECTION

A. Toilet Room Accessories: Engage the services of the approved manufacturer's inspection service, to inspect the installation of all Toilet Room accessories specified herein, and report any installation adjustments required to place all accessories in perfect working order, at no cost to the Owner.

3.05 MAINTENANCE INSTRUCTIONS

A. Furnish the Owner with all manufacturer's printed data, including service and parts manual, necessary for proper cleaning and maintenance of the products specified herein.

3.06 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

The requirements of the “General Conditions”, the “Supplementary Conditions”, and “Division 1” sections of the Specifications, shall apply to this section of the Specifications.

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Provide all labor, materials, equipment, apparatus, tools, transportation, protection and services necessary for, and reasonably incidental to the proper execution and completion of all Fire Protection Specialties Work, as indicated on the Drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Portable Fire Extinguishers and Accessories.

1.02 REFERENCE SPECIFICATIONS, CODES, AND APPLICABLE STANDARDS

A. Requirements of Regulatory Agencies: Furnish miscellaneous accessories in accordance with laws, codes, ordinances and regulations of the public authorities having jurisdiction, including Title III of The Americans with Disabilities Act (ADA), Public Law 101-336.

1.03 QUALITY ASSURANCE

A. General: All materials, articles, accessories incorporated in the Work shall be type and quality specified herein, and subject to the Architect’s review. Methods of preparation, construction and installation of such materials, articles and accessories shall be strictly in accordance with the accepted standard practices, manufacturer’s printed specifications and/or instructions, the rchitect’s Drawings and Specifications, and as directed by the Architect.

B. UL-Listed Products: Fire extinguishers shall meet Underwriters Laboratories Inc., UL 299 UL Standard for Safety Dry Chemical Fire Extinguishers.

1.04 SUBMITTALS

A. Reports: Submit test reports, procedure specifications and certifications as required to substantiate welded connections design and welding qualifications to the Owner’s Representative and the General Contractor for review.

B. General: Submit Shop Drawings, Product Data and Samples to the Architect for review in accordance with the requirements in Section 01 33 23 - Shop Drawings and Samples, and as specified herein.

C. Shop Drawings: Submit fully detailed layout and setting drawings, illustrative plates or drawings, and Supplementary Shop Drawings of all items.

D. Samples: Submit 4" x 4" Samples of fire extinguisher cabinets colors and/or finishes specified herein, for approval PRIOR to installation. Written approval shall be secured from the Architect, and installed materials shall match approved Samples.

1.05 MATERIAL DELIVERY AND STORAGE

A. Delivery: Deliver only acceptable materials to the site in original boxes, crates, and wrappings, clearly labeled with all pertinent information to facilitate checking.

B. Storage: Materials shall be stored at the site, off the ground in properly protected dry storage facilities, until ready for use. Damaged materials will not be acceptable, and shall be removed from the site.

C. Packaging Waste Management: Separate packaging waste materials for reuse, recycling and/or landfill.

1.06 WARRANTY

A. Form of Warranty: Execute a warranty in the approved written form, warranting all materials and workmanship to remain in serviceable and satisfactory condition, and to make good at own expense any imperfections which may develop during the warranty period, and any damage to other Work caused by imperfections or by repairing imperfections. The warranty period shall be not less than one (1) year from date of Owner's acceptance.

B. Fire Extinguishers: In addition to the above warranty, the fire extinguisher manufacturer shall provide industry standard of not less than a six (6) year written warranty covering materials and workmanship, at no charge to the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturer: Fire Extinguishers and Accessories and Fire Extinguisher Semi-Recessed Cabinets specified herein shall be as manufactured by Larsen's® Manufacturing Company, 7421 Commerce Lane N.E., Minneapolis, MN 55432, (763)571-1181 or (800)527-7367; www.larsensmfg.com.

2.02 PORTABLE FIRE EXTINGUISHERS

A. Fire Extinguishers: Larsen's®, MP Series Multi-Purpose Dry Chemical Model Number MP5 extinguishers.

1. Type: Extinguishers as specified herein shall be portable, hand-carried type, 5 pound nominal capacity, with self-closing hand valve, discharge hose, pressure gauge, in manufacturer's standard container with corrosion and impact resistant polyester/epoxy "red" paint finish. UL Rating 2A-10B:C for Class A, B and C fires.

2. Miscellaneous Requirements: Furnish test, refill schedules, procedures, and recertification requirements in accordance with National Fire Protection Association, NFPA 10 - Standard for Portable Fire Extinguishers, latest edition.

B. Fire Marshal's Approval: Size, type, and quantities of fire extinguishers as indicated on the Drawings and/or specified herein shall be subject to review and approval by the Fire Marshal.

C. Accessories:

1. Mounting Brackets: Provide manufacturer's recommended and compatible standard mounting extinguisher brackets and anchors. Brackets shall be of size and design to accommodate the accepted manufacturer's fire extinguishers.

2. Signage: Provide signs identifying the locations of fire extinguishers as required by local authorities.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 31 00 – Project Management & Coordination

B. Refer to Section 01 73 00 - Execution

3.02 INSTALLATION

A. General: Provide products specified herein for installations, as indicated on the Drawings or required.

1. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.

2. Comply with ADA and code requirements for facilities for individuals with a disability. Should governing code requirements differ from any specified herein, the more stringent requirement shall be met.

3. Fire extinguisher cabinets and mounting brackets for wall hung fire extinguishers shall be securely fastened to structure, square and plumb, and in compliance with manufacturer's instructions.

4. Protective covers installed by manufacturers to protect the finishes, shall not be removed until final cleaning.

B. Fire Extinguishers: Provide portable fire extinguishers for wall mounted installations on mounting brackets, in quantities as required by the Fire Marshal.

1. General: Install fire extinguishers and identifying signs in accordance with local authorities, ADA guidelines, and manufacturer's recommendations, at locations designated by the Fire Marshal.

2. Inspection: Verify servicing, charging and tagging of all fire extinguishers.

3.03 MAINTENANCE INSTRUCTIONS

A. Furnish the Owner with all manufacturers' printed data, including service and parts manual, necessary for proper maintenance of the products specified herein.

3.04 CLEAN-UP

A. Waste Management: Collect field generated construction waste created during construction or final cleaning.

END OF SECTION

SECTION 31 63 30
CONTINUOUS AND INDIVIDUAL SPREAD FOOTINGS

PART 1 GENERAL

1.1 REFERENCED DOCUMENTS

A. The "General Provisions" supplemental General Provisions, special provisions, and applicable portions of Division I. General requirements of the specifications are here by made a part of this section.

B. Related Sections
1. Reinforcing Steel: Section 03 21 00
2. Concrete: Section 03 30 00

1.2 WORK INCLUDED

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

1.3 CODES AND STANDARDS

A. The work described in this Section, unless otherwise noted on the Drawings, or herein specified, shall be governed by the latest editions of the following codes or specifications.
1. ACI 301, "Specifications for Structural Concrete for Buildings".
2. ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
3. ACI 305, "Hot Weather Concreting".
4. ACI 306, "Cold Weather Concreting".
5. ACI 311, "ACI Manual of Concrete Inspection".
6. ACI 318, "Building Code Requirements for Reinforced Concrete".

B. Maximum lateral variation off of centerlines: 2".

C. Plan Dimensions: Plus 3", minus ½".

D. Thickness: Not smaller than scheduled sizes.

E. Top of Footing Elevation: Plus 0", minus 3".

PART 2 PRODUCTS

2.1 MATERIALS

A. Reinforcement: Refer to Section 03 21 00.

B. Concrete: Refer to Section 03 30 00

PART 3 EXECUTION

3.1 EXCAVATION

A. Spread footings shall extend to and penetrate bearing materials as shown of the Drawings.

B. Excavations and footings shall be the size and shape as shown on the Drawings. The bottom of each excavation shall be level, undisturbed, free of water, caving material or any other foreign substance.

3.2 FABRICATION AND PLACING OF REINFORCING

A. All steel reinforcing mats shall be completely fabricated in a rigid fashion in order to permit expeditious placement into the excavation with a minimum time delay.

3.3 FIELD QUALITY CONTROL

A. Testing Laboratory services shall be in accordance with Section 01 45 29.

B. Testing Laboratory shall inspect each footing excavation to determine that proper bearing stratum is obtained and utilized for bearing and that excavations are properly clean and dry before placing concrete.

C. Furnish complete footing log showing location, elevation of top of bearing stratum, footing size and depth, condition of the material, excavation properly clean and dry before placing concrete, reinforcement in compliance with the Contract Documents and any and all observed irregularities, deficiencies or deviations from the Contract Documents.

3.4 INSPECTION

A. Footing excavation shall be scheduled such that the concrete can be placed immediately after inspection.

3.5 PLACING OF CONCRETE

A. All concrete shall be placed so as to prevent segregation. Do not allow concrete to free fall over 8'-0"; provide tremie, chutes or other means of conveyance when drop exceeds this amount.

B. Concrete shall be placed as soon as practical after the excavation has been completed and in no case shall the time lapse between completion of the excavations and concrete placement therein exceed eight hours.

END OF SECTION

SECTION 15010 - MECHANICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

A. Drawings and general provisions of contract, including General and Supplementary Conditions, and Division 1 Specification Section apply to this and other sections of Division 15.

B. Before submitting his proposal, each bidder shall examine all plans and specifications relating to the work, visit the site(s) of the proposed project, and become fully informed of the extent and character of the work required.

1.2 REFERENCE STANDARDS

A. Perform all Division 15 work in strict accordance with the Laws and Regulations of the State of Texas, and County and City codes/ordinances having jurisdiction over the project.

1.3 COORDINATION

A. Coordinate work under this Division to avoid conflicts and to attain satisfactory and complementary systems.

B. Coordinate work under this Division with work under other Divisions to avoid conflicts and to allow for adequate installation, maintenance, and operating space. Obtain the Architect's approval for penetrations of other parts of the Work prior to affecting them.

C. Prepare coordination drawings in accordance with Division 1 to a scale of ¼"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow if the work.

1.4 DEFINITIONS

Specific meanings used in Division 15 (variant forms are inferred):

A. Work: This project, or the reference part.

B. Provide:

1. Furnish and install, complete with necessary appurtenances.
2. "Provide" is implied throughout this Division unless language is specific.

C. Required: Required by the contract Documents.

D. Necessary: Necessary in order to obtain a finished system in satisfactory operating condition, and meeting all requirements.

E. Furnish: Procure and deliver, ready for installation, necessary and/or required.

F. Install: Receive, place securely, ready for connection to work specified elsewhere, and bring into satisfactory operating condition, as necessary and/or required.

G. Connect: Connect properly to mechanical work. This includes non-physical “connections” such as indirect waste drains.

H. Architect, Project Architect or Architect/Engineer Team.

1.5 SCOPE OF WORK

A. The work under this Division includes providing complete mechanical systems for the project.

B. All items of labor, material or equipment not required in detail by the specifications or plans, but incidental to, or necessary for the complete installation and proper operation of all phases of work described herein, or reasonably implied in connection therewith, shall be furnished as if called for in detail by the Contract Documents.

1.6 WORKMANSHIP

A. All labor shall be performed in a workmanlike manner by mechanics skilled in their particular trades. All installations shall be complete in both effectiveness and appearance whether finally enclosed or left exposed. The architect reserves the right to direct the removal or replacement of any item which in his opinion shall not present a reasonable neat or workmanlike appearance, providing that same can be properly installed in an orderly way.

1.7 MANUFACTURER’S INSTRUCTIONS

A. All equipment and devices shall be installed in accordance with the plans and specifications, manufacturer’s instructions and applicable codes. Contractor shall obtain written recommendations of installation and start-up instructions from material vendors and comply, unless otherwise required. Bring discrepancies between these instructions and project requirements to the attention of the Architect, and resolve prior to construction. Provide signed inspection report by manufacturer’s representative at system start-up to verify all is in compliant for product warranty.

1.8 WARRANTY

A. The contractor shall warranty his work against defective materials and workmanship for a period of 1-year from date of acceptance of the job.

1.9 TRAINING

A. Upon completion of the work and at a time designated by the Owner's representative, provide a formal training session for the Owner's operating personnel to include location, operation, and maintenance of all mechanical equipment and systems.

1.10 PERMITS AND FEES

A. Permits: Obtain special permits necessary for this portion of the Work.

B. Fees: Pay any fees associated with permits, required inspections, and permanent utility connections to this part of the work.

1.11 LICENSES

A. Work under this Division shall be performed by organizations and individuals holding a current license to perform such type of work by the authority having jurisdiction. "License" in this sense means any process, regardless of its appellation, which is normally mandated by the authority in order to perform such type of work within its jurisdiction. The stipulation of this paragraph applies even if the work is located physically on property owned or controlled by a higher authority. E.G., to work within the city limits of Corpus Christi, Texas, on a Federal project, State of Texas and City of Corpus Christi licenses which would be mandated to work on a private project shall be required even though the City and State may have no jurisdiction over the higher government.

B. In the event that the licensed organization loses its license or is unable to obtain one, or the licensed individual performing the work becomes unlicensed or deports the organization, notify Architect immediately in writing.

1.12 UTILITY COORDINATION

A. Permanent: Provide all ancillary work necessary to obtain utility connections. Pay connection fees. Arrange for connection in a timely manner. Coordinate time and arrangement of other work with the serving utility, and comply with utility standards.

B. Temporary: Refer to Division 1.

C. General: The contractor shall verify to his own satisfaction the location, elevation and availability of all utilities and services required, and shall adequately inform himself as

to their relation to the work. The contractor shall also verify location, conduct all necessary tests, inspections, coordinate with owner's representatives and utilities, and check or existing underground utilities and lines before ditching. Repair of any cut or damaged lines or utilities shall be the sole responsibility of the contractor.

1.13 LISTING AND LABELING

Materials required to be listed shall be listed and labeled for the particular service if a listing is available. Obtain and comply with the terms of listings. Listed material include.

A. NSF: Potable water and sanitary waste systems components.
B. UL: Electrical materials.
C. AMCA: Air moving devices and related accessory items.
D. ARI: HVAC equipment.
E. FM or UL: Hazardous fluid and fire protection system components.
F. FIA, FM or AGA: Fuel gas system components.

1.14 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new. Products shall be currently manufactured.
B. All materials and equipment shall be clearly marked, stamped or labeled for identification. Do not obscure nameplates. Where manufactures nameplates do not meet the requirements of the mechanical identification specification provide nameplates in accordance with the specification.
C. All products of similar type shall be provided by a single manufacturer throughout the project.

1.15 SUBMITTALS AND REVIEW

A. Contractor shall furnish to the Architect, within a reasonable time after award of contract, and prior to commencing any work, complete brochures in quadruplicate (plus quantity required by the Contractor) of all materials and equipment which the contractor proposes to furnish on the project. Data shall include descriptive literature, performance data, diagrams, capacity information, etc., to substantiate that proposed equipment will meet all of the requirements of the plans and specifications.
B. All data must be checked and any required changes noted thereon by the contractor, signed and dated prior to furnishing same to the Architect for approval. Contractor's attention is directed that it is mandatory that he thoroughly review data prior to

furnishing same to assure that equipment is in accordance with plans and specifications and to assure prompt return of the data.

C. Deviations: Specifically call to the attention of the Architect every proposed deviation from the Contract Document requirements. Failure to identify deviations as such constitutes a representation that all requirements are not met.

D. Review: Review of submittals shall not be constructed as releasing the Contractor from responsibility, but rather as a means to facilitate coordination of the work and the proper selection and installation of the products. All work shall be subject to final acceptance by the Architect at the completion of the project.

E. If above information is not provided complete as specified above and within the allocated time, all equipment shall be furnished exactly as specified without any substitutions.

1.16 SUBSTITUTIONS

A. Refer to the Conditions of the Contract.

B. Where one vendor is indicated for a product, it is to establish a level of quality and performance; provide a product equal to that product in all respects from a vendor of equivalent performance.

C. Where multiple vendors are indicated for a product, any of those vendors meeting the requirements may be submitted.

D. Some product specifications in this Division are of the Acceptable Manufacturer type. Vendors listed as Acceptable Manufacturers are acceptable as vendors. However, the product submitted is subject to review as being fully equivalent in detail to the basis of design.

E. Where multiple vendors are listed with product model numbers, each model and vendor is acceptable, provide all requirements are met. Model numbers are indicated to the extent believe necessary to identify a type and are not necessary completely.

F. The architectural/engineering team has designed the facility using requirements of the Basis of Design equipment. Any substitutions from the basis of design, which will require additional A/E design and/or coordination, shall include the cost of necessary redesign by professionals licensed in the respective disciplines and the approval of the professional of record.

1.17 DRAWINGS AND SPECIFICATIONS

A. These specifications are accompanied by Drawings. The Drawings and Specifications are complementary each to the other, and what is called for by one shall be as binding as if called for by both.

B. The Drawings are generally diagrammatic. Lay out work at the site to conform to existing conditions; architectural, structural, mechanical, and electrical conditions; to avoid all obstructions; and to conform to details of installation as required. Provide an integrated satisfactorily operating installation. All necessary offsets in piping, fittings, duct, etc., required to avoid interferences between piping, equipment, architectural, and structural elements shall be provided by the Contractor. Provide all necessary routing and offsets to avoid conflict.

C. Verify and arrange that sufficient space is provided for the installation of proposed products and that adequate access will exist for service and maintenance of equipment. For this work, adequate access shall be defined as meaning that service personnel can access and maintain a piece of equipment without having to alter permanent construction. Further, for equipment located above ceilings, access shall be available within 3 feet pf ceiling opening or lay-in ceiling.

1.18 COMPLEMENTARY DOCUMENTS

A. Contract documents are complementary; requirements are not necessarily repetitively stated at each possible subject; consider that a requirement applies wherever applicable.

B. In the event of conflicting requirements in different parts of the Documents, the more expensive shall be presumed to apply, unless the Architect clarifies the requirement in a less expensive manner and waives the more expensive requirement in writing. Since codes and standards are incorporated by reference, a particular conflict may appear in that a reference may use language that implies that a particular requirement in the Construction Documents is waived under the reference. This is not the case, unless specifically so clarified by the Architect. Generally, the specific Drawings and Specifications take precedence over waivers in multi-purpose reference documents.

C. Because of licensure and workmanship requirements, persons performing the work are presumed to be familiar with applicable codes, ordinances, laws, regulations and standards. Therefore, details of materials, methods, arrangements and size contained in such publications are not necessarily replicated in the Contract Documents. This in

no way deletes the requirement of the Contractor to comply. In the event of an apparent conflict between such publications and the Contract Documents, request clarification from the Architect prior to construction.

1.19 PROTECTION

A. All work, equipment and materials shall be protected at all times to prevent damage or breakage either in transit, storage, installation or testing. All openings shall be closed with caps or plugs during installation. All materials and equipment shall be covered and protected against dirt, water, chemicals or mechanical injury.

1.20 CUTTING AND PATCHING

A. All subcontractors shall notify the General Contractor sufficiently ahead of construction of any floor, walls, ceiling, roof, etc., of any openings that will be required for his work. All necessary cutting of walls, floors, partitions, ceilings, etc., as required for the proper installation of the work under this Contract shall be done at the Subcontractor's expense in a neat and workmanlike manner.

1.21 DEMOLITION

A. It shall be the responsibility of the contractor to see that all demolition and remodeling work involving his trade is accomplished in a manner and completeness to provide the appearance of new construction work.

B. Coordinate with other divisions before commencing work.

C. Abandoned air conditioning units shall be removed and disposed of off site in a legal manner.

D. All abandoned and/or otherwise unused piping shall be securely capped using materials of the same composition as the original piping.

1.22 RECORD DOCUMENTS

A. Drawings: The Contractor shall maintain and update daily a set of "blueline" prints in the Field Office for the sole purpose of recording "installed" conditions. Revise the drawings to reflect as-built conditions, including all addenda, change orders, final shop drawing reviews, and field routing. Underground utilities shall be dimensionally located relative to readily accessible and identifiable permanent reference points, with accurate slope and elevation indicated. Submit prints for review. Revise, certify accuracy, and provide two final sets to the Architect.

B. Owner's Manual: Prior to final acceptance, provide two bound volumes to the Architect. Index by subject. Include corrected submittals and shop drawings that reflect final review comments; installation, operation and maintenance instructions, parts lists, wiring diagrams, and piping diagrams; warranties.

1.23 INSPECTION, OBSERVATION, AND TESTING

A. Cooperate with Architect's representative and authorities having jurisdiction. Provide complete access to the work at reasonable times.

B. Cover-up: Prior to covering up work, or conducting observed tests, request observation as appropriate. Provide adequate advance notice defined as a minimum of five working days. In some cases the Architect's representative may waive observation; otherwise arrange for observed construction and testing prior to cover-up. Should minimize required notice not to be provided and the contractor covers up work requiring observation, such work shall be uncovered at contractor's expense.

C. Pre-Testing: Self-inspect, pre-test, and remedy work prior to performing observed test.

D. Sectional Work: In circumstances where a requirement for phased construction or other considerations dictate sectional construction and/or testing, notify the Architect when construction begins on the first section of a system, and when the first section will be ready for observed testing, as well as subsequent sections. Test in the largest practical sections.

1.24 WORK PERFORMED UNDER OTHER DIVISIONS

A. Refer to Division 2 for piped utilities beyond 5 feet from the building.

B. Refer to Division 16 for power wiring systems external to equipment and control panels; starters in motor centers; safety switches not integral to equipment or starters provided under Division 15.

C. Refer to Division 14 for kitchen, laboratory, medical and like equipment.

1.25 REFERENCE TO OTHER DIVISIONS

A. Refer to Division 16 for additional material requirements of electrical components provided under Division 15, such as loose starters, wiring and devices integral to equipment.

B. Refer to Division 2 for additional requirements governing excavation and backfill, supplemental to the requirements stated in this Division 15.

C. Comply with all requirements applicable to work required under this Division.

1.26 TESTING SERVICES

A. Additional Testing: In addition to any specified testing, the Architect may cause additional testing to be performed by an independent testing laboratory or any other qualified party. If such testing reveals deficient work by the Contractor, the Contractor shall pay for both the testing and remedial work. If such testing does not reveal deficient work by the Contractor, the Owner shall pay for the testing and the cost of repairing any damage caused by such testing.

B. Specified Testing Services: If independent testing services are specified regarding work under this Division, cooperate fully with the testing agency. Provide access to the work. Provide test holes and taps necessary. Remove work that is not tested on site, deliver to testing agency, and reinstall if undamaged; replace if damaged. Provide utilities, operational capability, and facilities for on-site testing as necessary.

1.27 WORK BY OWNER

A. The owner will award contracts on work which includes:

1. None.

1.28 OWNER FURNISHED PRODUCTS

A. Products furnished to the site and paid for by the Owner.

1. None.

END OF SECTION 15010

SECTION 15050 - MECHANICAL MATERIALS AND METHODS

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 basic mechanical materials and methods to complement other Division 15 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete base construction requirements.
3. Escutcheons.
4. Dielectric fittings.
5. Flexible connectors.
6. Mechanical sleeve seals.
7. Equipment nameplate data requirements.
8. Labeling and identifying mechanical systems and equipment is specified in Division 15 Section "Mechanical Identification."
9. Nonshrink grout for equipment installations.
10. Field-fabricated metal and wood equipment supports.
11. Installation requirements common to equipment specification sections.
12. Mechanical demolition.
13. Cutting and patching.
14. Touchup painting and finishing.

B. Pipe and pipe fitting materials are specified in Division 15 piping system Sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. NP: Nylon plastic.
4. PE: Polyethylene plastic.
5. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data Book: Submit product data for all Division 15 items in a single reinforced 3-ring binder. Organize product data by specification section number. Provide table of contents showing the following:
1. Specification Section
2. Description of item
3. Submission number (1st submission, 2nd submission, etc.)
4. Submittal status (Approved, Revise and Resubmit, etc.)

B. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

C. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

D. Coordination Drawings: For access panel and door locations.

E. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:

1. Planned piping layout, including valve and specialty locations and valve-stem movement.
2. Clearances for installing and maintaining insulation.

3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
4. Equipment and accessory service connections and support details.
5. Exterior wall and foundation penetrations.
6. Fire-rated wall and floor penetrations.
7. Sizes and location of required concrete pads and bases.
8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
9. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
10. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

F. Samples: Of color, lettering style, and other graphic representation required for each identification material and device.

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dielectric Unions:

    a. Capitol Manufacturing Co.
    b. Central Plastics Co.
    c. Eclipse, Inc.; Rockford-Eclipse Div.
    d. Epco Sales Inc.
    e. Hart Industries International, Inc.
    f. Watts Industries, Inc.; Water Products Div.
    g. Zurn Industries, Inc.; Wilkins Div.

2. Dielectric Flanges:

a. Capitol Manufacturing Co.
b. Central Plastics Co.
c. Epco Sales Inc.
d. Watts Industries, Inc.; Water Products Div.

3. Dielectric-Flange Insulating Kits:

a. Calpico, Inc.
b. Central Plastics Co.

4. Dielectric Couplings:

a. Calpico, Inc.
b. Lochinvar Corp.

5. Dielectric Nipples:

a. Grinnell Corp.; Grinnell Supply Sales Co.
b. Perfection Corp.
c. Victaulic Co. of America.

6. Metal, Flexible Connectors:

a. ANAMET Industrial, Inc.
b. Central Sprink, Inc.
c. Flexicraft Industries.
d. Flex-Weld, Inc.
e. Grinnell Corp.; Grinnell Supply Sales Co.
f. Hyspan Precision Products, Inc.
g. McWane, Inc.; Tyler Pipe; Gustin-Bacon Div.
h. Mercer Rubber Co.
i. Metraflex Co.
j. Proco Products, Inc.
k. Uniflex, Inc.

7. Rubber, Flexible Connectors:

a. General Rubber Corp.
b. Mercer Rubber Co.
c. Metraflex Co.
d. Proco Products, Inc.
e. Red Valve Co., Inc.
f. Uniflex, Inc.

8. Mechanical Sleeve Seals:

a. Calpico, Inc.
b. Metraflex Co.

c. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.
3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.
4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

F. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer's standard solvent cements for the following:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.

J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

1. Sleeve: ASTM A 126, Class B, gray iron.
2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.

C. Insulating Material: Suitable for system fluid, pressure, and temperature.

D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.5 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:

1. 2-Inch NPS and Smaller: Threaded.
2. 2-1/2-Inch NPS and Larger: Flanged.
3. Option for 2-1/2-Inch NPS and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

E. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 deg F. Units may be straight or elbow type, unless otherwise indicated.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.7 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

    a. Underdeck Clamp: Clamping ring with set screws.

5. PVC: Manufactured, permanent, with nailing flange for attaching to wooden forms.
6. PVC Pipe: ASTM D 1785, Schedule 40.
7. PE: Manufactured, reusable, tapered, cup shaped, smooth outer surface, with nailing flange for attaching to wooden forms.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw.

    a. Finish: Rough brass.
    b. Finish: Polished chrome-plate.

4. Cast Brass: Split casting, with concealed hinge and set screw.

    a. Finish: Rough brass.
    b. Finish: Polished chrome-plate.

5. Stamped Steel: One piece, with set screw and chrome-plated finish.
6. Stamped Steel: One piece, with spring clips and chrome-plated finish.
7. Stamped Steel: Split plate, with concealed hinge, set screw, and chrome-plated finish.
8. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
9. Stamped Steel: Split plate, with exposed-rivet hinge, set screw, and chrome-plated finish.
10. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome-plated finish.
11. Cast-Iron Floor Plate: One-piece casting.

2.8 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 15 Sections. If more than one type is specified for application, selection is Installer's option, but provide one selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
2. Location: Accessible and visible location.

C. Stencils: Standard stencils, prepared for required applications with letter sizes complying with recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inch- high letters for ductwork and not less than 3/4-inch- high letters for access door signs and similar operational instructions.

1. Material: Fiberboard.
2. Material: Brass.
3. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicated; either brushing grade or pressurized spray-can form and grade.
4. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap on, color-coded, complying with ASME A13.1.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl, complying with ASME A13.1.

F. Plastic Duct Markers: Manufacturer's standard color-coded, laminated plastic. Comply with the following color code:

1. Green: Cold air.
2. Yellow: Hot air.
3. Yellow/Green or Green: Supply air.
4. Blue: Exhaust, outside, return, and mixed air.
5. For hazardous exhausts, use colors and designs recommended by ASME A13.1.
6. Nomenclature: Include the following:

    a. Direction of airflow.
    b. Duct service.
    c. Duct origin.
    d. Duct destination.
    e. Design cubic feet per meter.

G. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated.

1. Fabricate in sizes required for message.
2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
3. Punch for mechanical fastening.
4. Thickness: 1/16 inch, unless otherwise indicated.
5. Thickness: 1/8 inch, unless otherwise indicated.
6. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches long; 1/8 inch for larger units.
7. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.

H. Plastic Equipment Markers: Color-coded, laminated plastic. Comply with the following color code:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Yellow/Green: Combination cooling and heating equipment and components.
4. Brown: Energy reclamation equipment and components.
5. Blue: Equipment and components that do not meet any criteria above.
6. For hazardous equipment, use colors and designs recommended by ASME A13.1.
7. Nomenclature: Include the following, matching terminology on schedules as closely as possible:

    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.
    d. Other design parameters such as pressure drop, entering and leaving conditions, and rpm.

8. Size: Approximate 2-1/2 by 4 inches for control devices, dampers, and valves; and 4-1/2 by 6 inches for equipment.

I. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: If multiple systems of same generic name are indicated, provide identification that indicates individual system number and service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

2.9 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 15 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

N. Sleeves are not required for core drilled holes.

O. Permanent sleeves are not required for holes formed by PE removable sleeves.

P. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

Q. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

    a. PVC Pipe Sleeves: For pipes smaller than 6-inch NPS.
    b. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
    c. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
    d. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

        1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials.
5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

R. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

S. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

T. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping" for materials.

U. Verify final equipment locations for roughing-in.

V. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

W. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube."
5. Soldered Joints: Construct joints according to CDA's "Copper Tube Handbook."
6. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
7. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded

pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
c. Align threads at point of assembly.
d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

8. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
9. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
10. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:

    a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
    b. ABS Piping: ASTM D 2235 and ASTM D 2661.
    c. CPVC Piping: ASTM D 2846 and ASTM F 493.
    d. PVC Pressure Piping: ASTM D 2672.
    e. PVC Nonpressure Piping: ASTM D 2855.
    f. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.

11. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.

    a. Plain-End Pipe and Fittings: Use butt fusion.
    b. Plain-End Pipe and Socket Fittings: Use socket fusion.

X. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.
3. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior nonconcealed locations:

    a. Near each valve and control device.
    b. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.

c. Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible enclosures.
d. At access doors, manholes, and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.
f. Spaced at maximum of 50-foot intervals along each run. Reduce intervals to 25 feet in congested areas of piping and equipment.
g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of mechanical equipment.

1. Lettering Size: Minimum 1/4-inch- high lettering for name of unit if viewing distance is less than 24 inches, 1/2-inch- high lettering for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish between multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows, showing duct system service and direction of flow.

1. Location: In each space, if ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 50 feet.

D. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.

3.4 PAINTING AND FINISHING

A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.

4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

C. Do not paint piping specialties with factory-applied finish.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 DEMOLITION

A. Disconnect, demolish, and remove Work specified in Division 15 Sections.

B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.9 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.10 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION 15050

SECTION 15067 - HANGERS AND SUPPORTS

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 hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 13 Section "Fire-Suppression Piping" for pipe hangers for fire-protection piping.
3. Division 15 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
4. Division 15 Section "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
5. Division 15 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.
4. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Fiberglass strut systems. Include Product Data for components.
4. Pipe stands. Include Product Data for components.
5. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1**, "**Structural Welding Code—Steel**"**

B. Welding: Qualify procedures and personnel according to the following:

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers: Similar to MSS Type 1, steel pipe hanger except hanger is made of fiberglass and continuous-thread rod and nuts are made of polyurethane or stainless steel.

1. Available Manufacturers:

    a. B-Line Systems, Inc.; a division of Cooper Industries.
    b. Champion Fiberglass, Inc.
    c. Cope, T. J., Inc.; Tyco International, Ltd.
    d. Seasafe, Inc.
    e. Unistrut Corp.; Tyco International, Ltd.
    f. Wesanco, Inc.

B. Strap-Type, Fiberglass Pipe Hangers: Made of fiberglass loop with stainless-steel continuous-thread rod, nuts, and support hook.

1. Available Manufacturers:

    a. Plasti-Fab, Inc.

2.5 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.6 FIBERGLASS STRUT SYSTEMS

A. Description: Shop- or field-fabricated pipe-support assembly, similar to MFMA-3, made of fiberglass channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Champion Fiberglass, Inc.
3. Cope, T. J., Inc.; Tyco International Ltd.
4. Seasafe, Inc.

2.7 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Available Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.8 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2.9 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Available Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1. Available Manufacturers:

a. MIRO Industries.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Available Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.
c. Portable Pipe Hangers.

2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Available Manufacturers:

a. Portable Pipe Hangers.

2. Bases: One or more plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.10 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.11 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 7 Section "Roof Accessories" for curbs.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65)] and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

N. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

P. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
    c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
    d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.

e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15062

SECTION 15077 – MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.
4. Stencils.
5. Valve tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the

Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.3 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.

C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

END OF SECTION 15077

SECTION 15080 - MECHANICAL INSULATION

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 mechanical insulation for duct, equipment, and pipe, including the following:

1. Insulation Materials:

    a. Phenolic Foam.
    b. Cellular glass.
    c. Flexible elastomeric.
    d. Mineral fiber.

2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Lagging adhesives.
7. Sealants.
8. Factory-applied jackets.
9. Field-applied fabric-reinforcing mesh.
10. Field-applied cloths.
11. Field-applied jackets.
12. Tapes.
13. Securements.
14. Corner angles.

B. Related Sections include the following:

1. Division 2 Section "Hydronic Distribution" for loose-fill pipe insulation in underground piping outside the building.

1.3 DEFINITIONS

A. ASJ: All-service jacket.

B. FSK: Foil, scrim, kraft paper.

C. FSP: Foil, scrim, polyethylene.

D. PVDC: Polyvinylidene chloride.

E. SSL: Self-sealing lap.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Insulation application at pipe expansion joints for each type of insulation.
3. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Removable insulation at piping specialties, equipment connections, and access panels.
5. Application of field-applied jackets.
6. Application at linkages of control devices.
7. Field application for each equipment type.

C. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control inspection reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and

cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 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. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Available Products:

    a. ACS.
    b. Pittsburgh Corning Corporation; Foamglas Super K.
2. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
3. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Available Products:

    a. Aeroflex USA Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Available Products:

    a. CertainTeed Corp.; Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Duct Wrap.
    d. Owens Corning; All-Service Duct Wrap.

I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Available Products:

    a. CertainTeed Corp.; Commercial Board.
    b. Johns Manville; 800 Series Spin-Glas.
    c. Knauf Insulation; Insulation Board.
    d. Owens Corning; Fiberglas 700 Series.

J. Mineral-Fiber, Preformed Pipe Insulation:

1. Available Products:
    a. Johns Manville; Micro-Lok.
    b. Knauf Insulation; 1000(Pipe Insulation.
    c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

2.3 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is UL tested and certified to provide a 1 or 2-hour fire rating, as required.

1. Products:

    a. CertainTeed Corp.; FlameChek.
    b. Johns Manville; Firetemp Wrap.
    c. Thermal Ceramics; FireMaster Duct Wrap.
    d. 3M; Fire Barrier Wrap Products.

2.4 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.5 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products:

2.6 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products:

a. Childers Products, Division of ITW; CP-30.
b. Foster Products Corporation, H. B. Fuller Company; 30-35.
c. ITW TACC, Division of Illinois Tool Works; CB-25.
d. Marathon Industries, Inc.; 501.
e. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.

3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

2.7 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
2. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).
3. Color: White.

2.8 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Products:

   a. Childers Products, Division of ITW; CP-76.
   b. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.

2.9 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

2.10 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.

B. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. (203 g/sq. m) with a thread count of 5 strands by 5 strands/sq. inch (2 strands by 2 strands/sq. mm) for covering equipment.

2.11 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).

2.12 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness 20 mil; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

4. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Thickness: 0.020” Smooth.
c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.13 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.

1. Width: 3 inches.

2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.14 SECUREMENTS

A. Bands:
1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.

2.15 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor

insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Through-Penetration Firestop Systems."

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies according to Division 7 Section "Through-Penetration Firestop Systems."

3.5 DUCT AND PLENUM INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install capacitor-discharge-weld pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

3.6 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.

8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

C. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from galvanized steel, at least 0.040 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.7 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe

insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.8 CELLULAR-GLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.9 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.10 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install capacitor-discharge-weld pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install capacitor-discharge-weld pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.12 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous UL-listed fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.13 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections. Paint only those items in exposed, public areas.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

    a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent inspecting agency to perform field inspections and prepare inspection reports.

B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements. Remove defective Work.

C. Install new insulation and jackets to replace insulation and jackets removed for inspection. Repeat inspection procedures after new materials are installed.

3.15 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in nonconditioned space.
4. Indoor, exposed return located in nonconditioned space.
5. Indoor, concealed oven and warewash exhaust.
6. Indoor, exposed oven and warewash exhaust.
7. Indoor, concealed exhaust air.
8. Indoor, exposed exhaust air.
9. Outdoor, concealed supply and return.
10. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.

6. Factory-insulated access panels and doors.

3.16 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

B. Concealed, round and flat-oval, return-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

C. Concealed, round and flat-oval, outdoor-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

D. Concealed, round and flat-oval, exhaust-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

E. Concealed, rectangular, supply-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

F. Concealed, rectangular, return-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

G. Concealed, rectangular, outdoor-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

H. Concealed, rectangular, exhaust-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

I. Concealed, return-air plenum insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
   2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

J. Exposed, round and flat-oval, supply-air duct insulation shall be the following:

   1. Double wall insulated duct.

K. Exposed, round and flat-oval, return-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
   2. Insulation not required in conditioned spaces.

L. Exposed, round and flat-oval, outdoor-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

M. Exposed, round and flat-oval, exhaust-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and nominal density.
   2. Insulation not required in conditioned spaces.

N. Exposed, rectangular, supply-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
   2. For rectangular ducts in public spaces, use double-wall insulated duct.

O. Exposed, rectangular, return-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and nominal density.
   2. Insulation not required in conditioned spaces.

P. Exposed, rectangular, outdoor-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

Q. Exposed, rectangular, exhaust-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
   2. Insulation not required in conditioned spaces.

R. Exposed, return-air plenum insulation shall be the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
   2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

3.17 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Round, flat-oval, and rectangular supply-air duct insulation shall be the following:
   1. Flexible Elastomeric: 3 layers, each 1” thick.

C. Round,flat-oval, and rectangular return-air duct insulation shall be the following:
   1. Flexible Elastomeric: 3 layers, each 1” thick.

3.18 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Chillers: Insulate cold surfaces on chillers, including, but not limited to, evaporator bundles, suction piping, compressor inlets, tube sheets, water boxes, and nozzles with the following:
   1. Flexible Elastomeric: 1 inch thick.

D. Heat-exchanger (water-to-water for cooling service) insulation shall be the following:
   1. Flexible Elastomeric: 1 inch thick.

E. Chilled-water pump insulation shall be the following:

1. Cellular Glass: 3 inches thick.

2. Phenolic Foam: 2 inches thick.

F. Condenser-water pump insulation shall be the following:
1. Not applicable.

G. Domestic water pump insulation shall be the following:
1. Not applicable.

H. Heating-hot-water pump insulation shall be the following:
1. Cellular Glass: 3 inches thick.

I. Chilled-water expansion/compression tank insulation shall be the following:
1. Flexible Elastomeric: 1 inch thick.

J. Chilled-water air-separator insulation shall be the following:
1. Flexible Elastomeric: 1 inch thick.

K. Domestic hot-water storage tank insulation shall be the following:

1. Mineral-Fiber Board: 4 inches thick and 2-lb/cu. ft. nominal density.

L. Thermal storage tank (brine, water, ice) insulation shall be the following:

1. Cellular Glass: 4 inches thick.

3.19 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Fire-suppression piping.
2. Drainage piping located in crawl spaces.
3. Below-grade piping.
4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.20 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1/2 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.

C. Domestic Chilled Water (Potable):

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.

D. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.
2. Insulation required only on horizontal runs.

E. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.

F. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 3/4 inch thick.

G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.

H. Chilled Water and Brine, above 40 Deg F:

1. NPS 4 DN 100 and Smaller: Insulation shall be the following:

   a. Cellular Glass: 1-1/2 inches thick.

   b. Phenolic Foam: 1 inch thick.

2. NPS 6 (DN 150) to NPS 12 (DN300: Insulation shall be the following:

   a. Cellular Glass: 2 inches thick.

   b. Phenolic Foam: 1 ½ inches thick.

3. NPS 14 (DN350) and Larger: Insulation shall be the following:

a. Cellular Glass: 2 - ½ inches thick.

b. Phenolic Foam: 2 inches thick.

I. Condenser-Water Supply and Return:

1. No insulation.

J. Heating-Hot-Water Supply and Return, 200 Deg F and below:

1. Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

K. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:
a. Flexible Elastomeric: 3/4 inch thick.

3.21 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

1. All Pipe Sizes: Insulation shall be the following:
a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. All Pipe Sizes: Insulation shall be the following:
a. Mineral-Fiber Pipe Insulation, Type I: 1 inches thick.

C. Chilled Water and Brine:

1. All Pipe Sizes: Insulation shall be the following:

a. Cellular Glass: Refer to interior schedule for thickness.

b. Phenolic Foam: Refer to interior schedule for thickness.

D. Condenser-Water Supply and Return:

1. All Pipe Sizes: Insulation not required.

E. Heating-Hot-Water Supply and Return, 200 Deg F and below:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber Pipe Insulation, Type I: 1 ½ inches thick.

F. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick.

3.22 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Loose-fill insulation, for belowground piping, is specified in Division 2 piping distribution Sections.

B. Chilled Water, All Sizes: Use pre-insulated pipe system.

C. Condenser-Water Supply and Return, All Sizes: Insulation not required. Provide anti corrosion coating as specified in Hydronic Piping Specification.

D. Heating-Hot-Water Supply and Return, All Sizes, 200 Deg F and below: Use pre-insulated pipe system.

3.23 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.

D. Ducts and Plenums, Exposed:

1. None.

E. Equipment, Concealed:

1. None.

F. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. None.

G. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. None.

H. Piping, Concealed:
1. ASJ – factory.

I. Piping, Exposed:
1. PVC: 20 mils thick.

3.24 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:
1. Painted Aluminum, Smooth: 0.020 inch thick.

D. Ducts and Plenums, Exposed:
1. Painted Aluminum, Smooth: 0.020 inch thick.

E. Equipment, Concealed:
1. PVC: 20 mils thick.

F. Equipment, Exposed:

1. Aluminum, Smooth: 0.020 inch thick.

G. Piping, Concealed:
1. PVC: 20 mils thick.

H. Piping, Exposed:
1. Aluminum, Smooth: 0.020 inch thick.

3.25 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 15080

SECTION 15110 - VALVES

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 general-duty valves:

1. Bronze angle valves.
2. Cast-iron angle valves.
3. Copper-alloy ball valves.
4. Ferrous-alloy ball valves.
5. Ferrous-alloy butterfly valves.
6. Bronze check valves.
7. Gray-iron swing check valves.
8. Ferrous-alloy wafer check valves.
9. Spring-loaded, lift-disc check valves.
10. Bronze gate valves.
11. Cast-iron gate valves.
12. Bronze globe valves.
13. Cast-iron globe valves.
14. Chainwheel actuators.

B. Related Sections include the following:

1. Division 2 piping Sections for general-duty and specialty valves for site construction piping.
2. Division 15 Section "Mechanical Identification" for valve tags and charts.
3. Division 15 piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.

5. SWP: Steam working pressure.
6. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.1 for power piping valves andASME B31.9 for building services piping valves.

1. Exceptions: Domestic hot- and cold-water, sanitary waste, and storm drainage piping valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:

1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.

G. Extended Valve Stems: On insulated valves.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

I. Valve Grooved Ends: AWWA C606.

1. Solder Joint: With sockets according to ASME B16.18.

a. Caution: Use solder with melting point below 840 deg F (454 deg C) for angle, check, gate, and globe valves; below 421 deg F (216 deg C) for ball valves.

2. Threaded: With threads according to ASME B1.20.1.

J. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE ANGLE VALVES

A. Manufacturers:

1. Type 2, Bronze Angle Valves with Nonmetallic Disc:
   a. Crane Co.
   b. Grinnell Corporation.
   c. Hammond Valve.
   d. NIBCO INC.

B. Bronze Angle Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 2, Class 150, Bronze Angle Valves: Bronze body with nonmetallic PTFE or TFE disc.

2.4 CAST-IRON ANGLE VALVES

A. Manufacturers:

1. Type II, Cast-Iron Angle Valves with Metal Seats:

   a. Crane Co.
   b. NIBCO INC.

B. Cast-Iron Angle Valves, General: MSS SP-85, Type II.

C. Class 125, Cast-Iron Angle Valves: Bronze mounted with gray-iron body and bronze seats.

2.5 COPPER-ALLOY BALL VALVES

A. Manufacturers:

1. Two-Piece, Copper-Alloy Ball Valves:

   a. Conbraco Industries, Inc.; Apollo Div.
   b. Crane Co.

c. Grinnell Corporation.
d. Hammond Valve.
e. Jamesbury, Inc.
f. Kitz Corporation of America.
g. Legend Valve & Fitting, Inc.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Red-White Valve Corp.
k. Watts Industries, Inc.; Water Products Div.

2. Safety-Exhaust, Copper-Alloy Ball Valves:

a. Conbraco Industries, Inc.; Apollo Div.
b. Grinnell Corporation.
c. Hammond Valve.
d. Jamesbury, Inc.
e. Milwaukee Valve Company.
f. NIBCO INC.

B. Copper-Alloy Ball Valves, General: MSS SP-110.

C. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

D. Safety-Exhaust, Copper-Alloy Ball Valves: Two-piece bronze body with exhaust vent opening, chrome-plated ball with vent, blowout-proof stem, locking handle, and working pressure rating of 600-psig CWP.

2.6 FERROUS-ALLOY BALL VALVES

A. Manufacturers:
1. Conbraco Industries, Inc.; Apollo Div.
2. Crane Co.
3. Hammond Valve.
4. Jamesbury, Inc.
5. Kitz Corporation of America.
6. Milwaukee Valve Company.
7. NIBCO INC.

B. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.

C. Ferrous-Alloy Ball Valves: Class 150, full port.

2.7 FERROUS-ALLOY BUTTERFLY VALVES

A. Manufacturers:

1. Single-Flange, Ferrous-Alloy Butterfly Valves:
   a. Bray International, Inc.
   b. Crane Co.
   c. Grinnell Corporation.
   d. Hammond Valve.
   e. Kitz Corporation of America.
   f. Legend Valve & Fitting, Inc.
   g. Metraflex Co.
   h. Milwaukee Valve Company.
   i. Mueller.
   j. NIBCO INC.
   k. Red-White Valve Corp.
   l. Tyco International.
   m. Watts Industries.

2. Grooved-End, Ductile-Iron Butterfly Valves:
   a. Grinnell Corporation.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. Mueller.
   e. NIBCO INC.
   f. Victaulic Co. of America.

B. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.

C. Single-Flange, 150-psig (1035-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer-lug type with one- or two-piece stem.

D. Grooved-End, 175-psig (1207-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Ductile-iron or steel body with grooved or shouldered ends.

2.8 BRONZE CHECK VALVES

A. Manufacturers:

1. Type 2, Bronze, Horizontal Lift Check Valves with Nonmetallic Disc:
   a. Crane Co.

2. Type 2, Bronze, Vertical Lift Check Valves with Nonmetallic Disc:

   a. Grinnell Corporation.
   b. Kitz Corporation of America.

c. Milwaukee Valve Company.

3. Type 4, Bronze, Swing Check Valves with Nonmetallic Disc:
   a. Crane Co.
   b. Grinnell Corporation.
   c. Hammond Valve.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Red-White Valve Corp.
   g. Watts Industries.

B. Bronze Check Valves, General: MSS SP-80.

C. Type 2, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

D. Type 2, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

E. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.9 GRAY-IRON SWING CHECK VALVES

A. Manufacturers:

1. Type II, Gray-Iron Swing Check Valves with Composition to Metal Seats:

   a. Crane Co.
   b. Mueller Co.
   c. Watts Industries.

2. Grooved-End, Ductile-Iron Swing Check Valves:

   a. Grinnell Corporation.
   b. Mueller Co.
   c. Victaulic Co. of America.

B. Gray-Iron Swing Check Valves, General: MSS SP-71.

C. Type II, Class 125, gray-iron, swing check valves with composition to metal seats.

D. 175-psig (1207-kPa) CWP Rating, Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends.

2.10 FERROUS-ALLOY WAFER CHECK VALVES

A. Manufacturers:

1. Dual-Plate, Ferrous-Alloy, Wafer Check Valves:

a. Crane Co.
b. Grinnell Corporation.
c. Metraflex Co.
d. Mueller.
e. NIBCO INC.
f. Red-White Valve Corp.
g. Watts Industries.

B. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.

C. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.

2.11 SPRING-LOADED, LIFT-DISC CHECK VALVES

A. Manufacturers:

1. Type II, Compact-Wafer, Lift-Disc Check Valves:
a. Grinnell Corporation.
b. Hammond Valve.
c. Metraflex Co.
d. Milwaukee Valve Company.
e. Mueller.
f. NIBCO INC.

2. Type IV, Threaded Lift-Disc Check Valves:
a. Grinnell Corporation.
b. Legend Valve & Fitting, Inc.
c. Metraflex Co.
d. Milwaukee Valve Company.
e. Mueller.
f. NIBCO INC.
g. Watts Industries.

B. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.

C. Type II, Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.

D. Type IV, Class 150, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.

2.12 BRONZE GATE VALVES

A. Manufacturers:

1. Type 2, Bronze, Rising-Stem, Solid-Wedge Gate Valves:
   a. Crane Co.
   b. Grinnell Corporation.
   c. Hammond Valve.
   d. Kitz Corporation of America.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Red-White Valve Corp.

B. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 2, Class 150, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge.

2.13 CAST-IRON GATE VALVES

A. Manufacturers:

1. Type I, Cast-Iron, Nonrising-Stem Gate Valves:
   a. Crane Co.
   b. Grinnell Corporation.
   c. Hammond Valve.
   d. Kitz Corporation of America.
   e. Legend Valve & Fitting, Inc.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Red-White Valve Corp.
   i. Watts Industries.

B. Cast-Iron Gate Valves, General: MSS SP-70, Type I.

C. Class 125, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.

2.14 BRONZE GLOBE VALVES

A. Manufacturers:

1. Type 1, Bronze Globe Valves with Metal Disc:
   a. Crane Co.
   b. Grinnell Corporation.
   c. Hammond Valve.
   d. Kitz Corporation of America.
   e. Legend Valve & Fitting, Inc.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Red-White Valve Corp.

2. Type 2, Bronze Globe Valves with Nonmetallic Disc:
   a. Crane Co.
   b. Grinnell Corporation.
   c. Hammond Valve.
   d. Kitz Corporation of America.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Red-White Valve Corp.

B. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 1, Class 125, Bronze Globe Valves: Bronze body with bronze disc.

D. Type 2, Class 150, Bronze Globe Valves: Bronze body with nonmetallic PTFE or TFE disc.

2.15 CAST-IRON GLOBE VALVES

A. Manufacturers:

1. Type I, Cast-Iron Globe Valves with Metal Seats:
   a. Crane Co.
   b. Grinnell Corporation.
   c. Hammond Valve.
   d. Kitz Corporation of America.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Red-White Valve Corp.

B. Cast-Iron Globe Valves, General: MSS SP-85.

C. Type I, Class 125, Cast-Iron Globe Valves: Gray-iron body with bronze seats.

2.16 CHAINWHEEL ACTUATORS

A. Manufacturers:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries, Inc.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve. Include zinc coating on exterior applications.
2. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
3. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, gate, or plug valves.
2. Throttling Service: Angle, ball, butterfly, or globe valves.
3. Pump Discharge: Spring-loaded, lift-disc check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Chilled-Water Piping: Use the following types of valves:

1. Angle Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
2. Angle Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, cast iron.
3. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 600-psig (4140-kPa) CWP rating, copper alloy.
4. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
5. Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: Single-flange, 150-psig (1035-kPa) CWP rating, ferrous alloy, with Buta-N liner.
6. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: 300-psig (2070-kPa) CWP rating.
7. Lift Check Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
8. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 150, bronze.
9. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, gray iron.
10. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: 175-psig (1207-kPa) CWP rating.
11. Wafer Check Valves, NPS 2-1/2 (DN 65) and Larger: Dual-plate, wafer, Class 125 or 150 ferrous alloy.
12. Spring-Loaded, Lift-Disc Check Valves, NPS 2 (DN 50) and Smaller: Type IV, Class 150.
13. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 (DN 65) and Larger: Type II, Class 125, cast iron.
14. Gate Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
15. Gate Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, NRS, bronze-mounted cast iron.
16. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
17. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.

D. Condenser Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
3. Butterfly Valves, NPS 2-1/2 and Larger: Single-flange, 150-psig CWP rating, ferrous alloy, with Buta-N liner.
4. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 300-psig CWP rating.
5. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
6. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
7. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, gray iron.

8. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
9. Wafer Check Valves, NPS 2-1/2 and Larger: Dual-plate, wafer, Class 125 or 150, ferrous alloy.
10. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
11. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.
12. Gate Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
13. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, NRS, bronze-mounted cast iron.
14. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
15. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, bronze-mounted cast iron.

E. Domestic Water Piping: Use the following types of valves:

1. Angle Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
2. Angle Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.
3. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
4. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
5. Butterfly Valves, NPS 2-1/2 and Larger: Single-flange, 150-psig CWP rating, ferrous alloy, with EPDM liner.
6. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 300-psig CWP rating.
7. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
8. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 125, bronze.
9. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, gray iron.
10. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
11. Wafer Check Valves, NPS 2-1/2 and Larger: Dual-plate, wafer, Class 125 or 150, ferrous alloy.
12. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
13. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.
14. Gate Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
15. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, NRS, bronze-mounted cast iron.
16. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
17. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, bronze-mounted cast iron.

F. Heating Water Piping: Use the following types of valves:

1. Angle Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.

2. Angle Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.
3. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
4. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
5. Butterfly Valves, NPS 2-1/2 and Larger: Single-flange, 150-psig CWP rating, ferrous alloy, with EPDM liner.
6. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 300-psig CWP rating.
7. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal vertical, bronze.
8. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
9. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, gray iron.
10. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
11. Wafer Check Valves, NPS 2-1/2 and Larger: Dual-plate, wafer, Class 125 or 150, ferrous alloy.
12. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
13. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.
14. Gate Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
15. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, NRS, bronze-mounted cast iron.
16. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
17. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, bronze-mounted cast iron.

G. Sanitary Waste and Storm Drainage Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
3. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
4. Swing Check Valves, NPS 2-1/2 and Larger: Type I or II, Class 125, gray iron.
5. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig minimum CWP rating.
6. Gate Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
7. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, NRS, bronze-mounted cast iron.
8. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
9. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, cast iron.

H. Select valves, except wafer and flangeless types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for heating hot water.
2. For Copper Tubing, NPS 2-1/2 (DN65) and larger: Flanged ends.
3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
4. For Steel Piping, NPS 2-1/2 (DN65) and larger: Flanged ends.

5. For Grooved-End, Copper Tubing and Steel Piping: Valve ends may be grooved. Do not use for steam or steam condensate piping.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install chainwheel operators on valves and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 15110

SECTION 15140 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes domestic water piping inside the building.

B. Water meters will be furnished and installed by utility company.

C. Related Sections include the following:
1. Division 2 Section "Water Distribution" for water-service piping outside the building from source to the point where water-service piping enters the building.
2. Division 15 Section "Plumbing Specialties" for water distribution piping specialties.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 80 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Water Samples: Specified in Part 3 "Cleaning" Article.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, Schedule 40, galvanized. Include ends matching joining method.
   1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
   2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body, with ball-and-socket, metal-to-metal, bronze seating surface and female threaded ends.
   3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
   4. Cast-Iron Flanges: ASME B16.1, Class 125.
   5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
   6. Steel-Piping, Grooved-End Fittings: ASTM A 47/A 47M, galvanized, malleable-iron casting; ASTM A 106, galvanized steel pipe; or ASTM A 536, galvanized, ductile-iron casting; with dimensions matching steel pipe.
      a. Grooved-End-Pipe Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
   7. Steel-Piping, Expansion Joints: Compound, galvanized steel fitting with telescoping body and slip-pipe section. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.
   8. Steel-Piping, Double Expansion Joints: Compound, galvanized steel fitting with telescoping body and two slip-pipe sections. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.

2.3 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, annealed temper.
   1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

B. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, drawn temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
4. Copper, Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
   a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

2.4 PVC PIPE AND FITTINGS

A. PVC Schedule 40 Pipe: ASTM D1785.
1. PVC Schedule 40 Fittings: ASTM D2466, socket type.

2.5 VALVES

A. Bronze and cast-iron, general-duty valves are specified in Division 15 Section "Valves."

B. Balancing and drain valves are specified in Division 15 Section "Plumbing Specialties."

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPE AND FITTING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Grooved joints may be used on aboveground grooved-end piping.

D. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

E. Underground, Water-Service Piping on Service Side of Water Meter: Refer to Division 2 Section "Water Distribution."

F. Underground, water-service piping on house side of water meter. Use any of the following piping materials:
   1. PVC Schedule 40 Pipe: ASTM D1785.
      a. PVC Schedule 40 Fittings: ASTM D2466, socket type.
   2. Soft copper tube, type K (type A); copper pressure fittings; and soldered joints.

G. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter, NPS 4 (DN 100) and Smaller: Soft copper tube, Type K (Type A); copper pressure fittings; and soldered joints.

H. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:
   1. NPS 3 (DN 80) and Smaller: Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
   2. NPS 4 to NPS 6 (DN 100 to DN 150): Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
   3. NPS 4 to NPS 8 (DN 100 to DN 200): Hard copper tube, Type L (Type B) with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
   4. NPS 8 to NPS 12 (DN 200 to DN 300): Steel pipe; gray-iron, threaded fittings; and threaded joints.
   5. NPS 8 to NPS 12 (DN 200 to DN 300): Steel pipe with grooved ends; steel-piping, grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
   2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
   3. Hot-Water-Piping, Balancing Duty: Memory-stop balancing valves.
   4. Drain Duty: Hose-end drain valves.

B. Cast-iron, grooved-end valves may be used with grooved-end piping.

C. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

D. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
   1. Install hose-end drain valves at low points in water mains, risers, and branches.
   2. Install stop-and-waste drain valves where indicated.

E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 15 Section "Plumbing Specialties."

3.4 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.

E. Install water-pressure regulators downstream from shutoff valves. Water-pressure regulators are specified in Division 15 Section "Plumbing Specialties."

F. Install domestic water piping level and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

3.5 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

D. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support devices are specified in Division 15 Section "Hangers and Supports." Install the following:
   1. Vertical Piping: MSS Type 8 or Type 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs: According to the following:
      a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet (30 m): MSS Type 49, spring cushion rolls, if indicated.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 15 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
   2. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
   3. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.

F. Install supports for vertical steel piping every 15 feet (4.5 m).

G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.

3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
7. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

H. Install supports for vertical copper tubing every 10 feet (3 m).

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:
1. Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.8 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:
1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:
1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 ADJUSTING

A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
   b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:
      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
      2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 15140

SECTION 15150 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections include the following:

1. Division 15 Section "Chemical-Waste Piping" for chemical-waste and vent piping systems.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. PE: Polyethylene plastic.

C. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:
   1. Sovent Drainage System: Include plans, elevations, sections, and details.

C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Lead and Oakum: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

   1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

   2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

C. Rigid, Unshielded Couplings: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.5 SPECIAL PIPE FITTINGS

A. Sovent Drainage System Fittings: ASME B16.45 or ASSE 1043, cast-iron aerator and deaerator fittings.

B. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Sleeve Materials:

a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

E. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

F. Tubular Fittings: ASTM F 409, PVC drainage-pattern tube and tubular fittings with ends as required for application.

2.6 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch (0.10-mm) minimum thickness.

B. Form: tube.

C. Color: Black.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Piping installed in building plenums shall meet requirements of materials within ducts or plenums (ceiling spaces used as supply or return air plenums) and shall have a flame-spread index of not more than 25 and a smoke-developed rating of not more than 50 when tested in accordance with the test for Surface Burning Characteristics of Materials.

C. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

D. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Aboveground, vent piping all sizes shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.

2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

F. Above and belowground, sovent drainage system with soil, waste, and vent piping materials indicated.

G. Underground, soil, waste, and vent piping all sizes shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, cast-iron couplings; and hubless-coupling joints.
3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 2 Section "Sanitary Sewerage."

B. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

I. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

K. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

L. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

E. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

F. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 15 Section "Valves."

B. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves.
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Backwater valve are specified in Division 15 Section "Plumbing Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 15 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 15 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.

2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.

F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and 5 (DN 100 and 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 8 to NPS 12 (DN 200 to DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

H. Install supports for vertical PVC piping every 48 inches (1200 mm).

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 15150

SECTION 15410 - PLUMBING FIXTURES

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 plumbing fixtures and related components.

B. Related Sections include the following:

1. Division 15 Section "Emergency Plumbing Fixtures."
2. Division 15 Section "Drinking Fountains and Water Coolers."
3. Division 15 Section "Plumbing Specialties" for backflow preventers and specialty fixtures not in this Section.

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.

E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Hand Sinks: NSF 2 construction.
3. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
4. Slip-Resistant Bathing Surfaces: ASTM F 462.
5. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
6. Vitreous-China Fixtures: ASME A112.19.2M.
7. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
8. Water-Closet, Flushometer Tank Trim: ASSE 1037.

I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.

2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucet Hose: ASTM D 3901.
5. Faucets: ASME A112.18.1M.
6. Hose-Connection Vacuum Breakers: ASSE 1011.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
9. NSF Materials: NSF 61.
10. Pipe Threads: ASME B1.20.1.
11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
12. Supply and Drain Fittings: ASME A112.18.1M.

J. Comply with the following applicable standards and other requirements specified for bathtub and shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Faucets: ASME A112.18.1M.
4. Hand-Held Showers: ASSE 1014.
5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Manual-Control Antiscald Faucets: ASTM F 444.
8. Pipe Threads: ASME B1.20.1.
9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

K. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1M.
3. Manual-Operation Flushometers: ASSE 1037.
4. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
5. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.

L. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Floor Drains: ASME A112.21.1M.
3. Hose-Coupling Threads: ASME B1.20.7.
4. Off-Floor Fixture Supports: ASME A112.6.1M.
5. Pipe Threads: ASME B1.20.1.

6. Plastic Shower Receptors: ANSI Z124.2.
7. Plastic Toilet Seats: ANSI Z124.5.
8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. For fixture descriptions in other Part 2 articles where the subparagraph titles "Manufacturers" introduce a list of manufacturers, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in other Part 2 articles.

2.2 LAVATORY FAUCETS

A. Lavatory Faucet,: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

   1. Available Manufacturers:

      a. American Standard.

      b. T & S Brass.

      c. Kohler.

      d. Chicago.

   2. Refer to Plumbing Schedule for specification standards.

2.3 BATHTUB FAUCETS

A. Bathtub Faucet: Include hot- and cold-water indicators; tub spout; and shower head, arm, and flange. Coordinate faucet inlets with supplies and outlet with diverter valve.
   1. Manufacturers:

      a. American Standard.

b. T & S Brass.

c. Kohler.

d. Chicago.

2. Refer to Plumbing Schedule for specification standards.

2.4 SHOWER FAUCETS

A. Shower Faucet: Include hot- and cold-water indicators; tub spout; and shower head, arm, and flange. Coordinate faucet inlets with supplies and outlet with diverter valve.
1. Manufacturers:

a. American Standard.

b. T & S Brass.

c. Kohler.

d. Chicago.

2. Refer to Plumbing Schedule for specification standards.

2.5 SINK FAUCETS

A. Sink Faucet: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.
1. Manufacturers:

a. American Standard.

b. T & S Brass.

c. Kohler.

d. Chicago.

2. Refer to Plumbing Schedule for specification standards.

2.6 FLUSHOMETERS

A. Flushometer: Cast-brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, and copper or brass tubing, and polished chrome-plated finish on exposed parts.

1. Manufacturers:

    a. Sloan, Royal.

    b. Zurn, Aquaflush, AT.

2. Refer to Plumbing Schedule for specification standards.

2.7 TOILET SEATS

A. Toilet Seat: Solid plastic.
    1. Manufacturers:

        a. Church.

        b. American Standard.

        c. Olsenite.

    2. Refer to Plumbing Schedule for specification standards.

2.8 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Guard: Manufactured, plastic covering for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.
    1. Manufacturers:

        a. Plumerer.

        b. Truebro.

        c. McGuire.

        d. Engineered Brass.

2.9 FIXTURE SUPPORTS

A. Water-Closet Support: Water-closet combination carrier designed for accessible or standard mounting height, as required. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
    1. Manufacturers:

        a. Josam.

b. Mifab.

c. Smith.

d. Wade.

e. Zurn.

B. Urinal Support: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include steel uprights with feet.
1. Manufacturers:

a. Josam.

b. Mifab.

c. Smith.

d. Wade.

e. Zurn.

2. Accessible Fixture Support: Include rectangular steel uprights.

C. Lavatory Support: Type II, lavatory carrier with concealed arms and tie rod. Include steel uprights with feet.
1. Manufacturers:

a. Josam.

b. Mifab.

c. Smith.

d. Wade.

e. Zurn.

2. Accessible Fixture Support: Include rectangular steel uprights.

D. Sink Support: Type II, sink carrier with hanger plate, bearing studs, and tie rod. Include steel uprights with feet.
1. Manufacturers:

a. Josam.

b. Mifab.

c. Smith.

d. Wade.

e. Zurn.

2.10 WATER CLOSETS

A. Water Closets,: Accessible and standard, wall hung and floor mounted, vitreous-china fixture designed for gravity-type tank, flushometer tank, or flushometer valve operation.
   1. Products:

      a. American Standard, Inc.
      b. Crane Plumbing/Fiat Products.
      c. Kohler Co.
      d. Eljer Plumbingware.

   2. Refer to Plumbing Schedule for Specification Standards.

2.11 URINALS

A. Urinals,: Accessible and standard Wall-hanging, bottom-outlet, vitreous-china fixture designed for flushometer valve operation.
   1. Products:

      a. American Standard.
      b. Crane Plumbing/Fiat Products.
      c. Kohler Co.
      d. Eljer Plumbingware.

   2. Refer to Plumbing Schedule for Specification Standards.

2.12 LAVATORIES

A. Lavatories: Accessible and standard, Wall-hanging, vitreous-china fixture.
   1. Products:
      a. American Standard, Inc.
      b. Crane Plumbing/Fiat Products.
      c. Kohler Co.
      d. Eljer Plumbingware.
   2. Refer to Plumbing Schedule for Specification Standards.

B. Lavatories: Accessible and Standard Counter-mounting, vitreous-china fixture.
   1. Products:
      a. American Standard, Inc.
      b. Crane Plumbing/Fiat Products.

c. Kohler Co.
d. Eljer Plumbingware Div.

2. Refer to Plumbing Schedule for Specification Standards.

2.13 KITCHEN SINKS

A. Kitchen Sinks: Counter-mounting, stainless-steel fixture.
1. Products:
a. Elkay Manufacturing Co.
b. Just Manufacturing Co.
c. Kohler Co.
d. Sterling Plumbing Group, Inc.
2. Refer to Plumbing Schedule for Specifications Standards.

B. Bar Sinks: Single-compartment, counter-mounting, stainless-steel fixture.
1. Products:
a. Elkay Manufacturing Co.
b. Federal Home Products Div.
c. Just Manufacturing Co.
d. Kohler Co.
e. Sterling Plumbing Group, Inc.
2. Refer to Plumbing Schedule for Specifications Standards.

2.14 SERVICE BASINS

A. Service Basins,: Flush-to-wall, floor-mounting precast terrazzo basin with rim guard.

1. Available Products:
2. Products:

a. Acorn Engineering Co.
b. Crane Plumbing/Fiat Products.
c. Precast Terrazzo Enterprises, Inc.
d. Stern-Williams Co., Inc.
3. Refer to Plumbing Schedule for Specification Standards.

2.15 WASH FOUNTAINS

A. Wash Fountains,: Accessible, Circular, semi-circular, and flush-to-wall freestanding-design and wall-hung, wash-up fixture.
1. Products:

a. Acorn Engineering Co.
b. Bradley Corporation.
c. Intersan Manufacturing Co.

2. Refer to Plumbing Schedule for Specification Standards.

2.16 SERVICE SINKS

A. Service Sinks,: Trap-standard- and wall-mounting, enameled, cast iron with roll-rim sink with plain or two faucet holes in back and rim guard on front and sides.
   1. Products:
      a. Kohler Co.
      b. Eljer Plumbingware.
      c. Crane Plumbing/Fiat Products.
   2. Refer to Plumbing Schedule for Specification Standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.

   1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
   3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-hanging fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Division 15 Section "Valves" for general-duty valves.

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

M. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

N. Install toilet seats on water closets.

O. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

P. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

Q. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

R. Install shower, flow-control fittings with specified maximum flow rates in shower arms.

S. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

T. Install disposer in outlet of sinks indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

U. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for escutcheons.

V. Set bathtubs, shower receptors, and service basins in leveling bed of cement grout. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for grout.

W. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

F. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 15410

SECTION 15430 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following plumbing specialties:

1. Backflow preventers.
2. Dishwasher air-gap fittings.
3. Water regulators.
4. Balancing valves.
5. Thermostatic water mixing valves.
6. Water tempering valves.
7. Strainers.
8. Outlet boxes.
9. Washer-supply outlets.
10. Hose stations.
11. Key-operation hydrants.
12. Wheel-handle wall hydrants.
13. Nondraining nonfreeze post hydrants.
14. Trap seal primer valves.
15. Drain valves.
16. Backwater valves.
17. Miscellaneous piping specialties.
18. Sleeve penetration systems.
19. Flashing materials.
20. Cleanouts.
21. Floor drains.
22. Trench drains.
23. Roof drains.
24. Grease interceptors.
25. Oil interceptors.
26. Solids interceptors.

1.3 DEFINITIONS

A. The following are industry abbreviations for plastic piping materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PE: Polyethylene plastic.
3. PUR: Polyurethane plastic.
4. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig (860 kPa).
2. Sanitary Waste and Vent Piping: 10-foot head of water (30 kPa).
3. Storm Drainage Piping: 10-foot head of water (30 kPa).

1.5 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

1. Backflow preventers and water regulators.
2. Balancing valves and strainers.
3. Thermostatic water mixing valves and water tempering valves.
4. Water hammer arresters, air vents, and trap seal primer valves and systems.
5. Drain valves, hose bibbs, hydrants, and hose stations.
6. Outlet boxes and washer-supply outlets.
7. Backwater valves, cleanouts, floor drains, open receptors, trench drains, and roof drains.
8. Air-admittance valves, vent caps, vent terminals, and roof flashing assemblies.
9. Grease interceptors, oil interceptors, and solids interceptors.
10. Sleeve penetration systems.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field test reports.

D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Backflow preventers and water regulators.
2. Thermostatic water mixing valves and water tempering valves.
3. Trap seal primer valves and systems.
4. Hose stations and hydrants.
5. Grease interceptors, oil interceptors, and solids interceptors.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Operating Key Handles: Equal to 100 percent of amount installed for each key-operated hose bibb and hydrant installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 BACKFLOW PREVENTERS

A. Available Manufacturers:

B. Manufacturers:
1. B & K Industries, Inc.
2. Cla-Val Co.
3. Conbraco Industries, Inc.
4. Mueller Co.; Hersey Meters Div.
5. Park Equipment.
6. Watts Industries, Inc.; Water Products Div.
7. Zurn Industries, Inc.; Wilkins Div.

C. General: ASSE standard, backflow preventers.

1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
2. NPS 2-1/2 (DN 65) and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.

    a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.

3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
5. Strainer: On inlet, if indicated.

D. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

E. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

F. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and two independent check valves with intermediate atmospheric vent.

G. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

1. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.

H. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.

1. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.

I. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.

1. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.

J. Dual-Check-Valve-Type Backflow Preventers: ASSE 1024, suitable for continuous pressure application. Include union inlet and two independent check valves.

K. Dual-Check-Valve-Type Backflow Preventers: ASSE 1032, suitable for continuous pressure application for carbonated beverage dispensers. Include stainless-steel body; primary and secondary checks; ball check; intermediate atmospheric-vent port for relieving carbon dioxide; and threaded ends, NPS 3/8 (DN 10).

L. Laboratory Faucet Vacuum Breakers: ASSE 1035, suitable for continuous pressure application and chrome plated; consisting of primary and secondary checks; intermediate vacuum breaker; and threaded ends, NPS 1/4 or NPS 3/8 (DN 8 or DN 10) as required.

M. Reduced-Pressure Detector Assembly Backflow Preventers: ASSE 1047, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves; and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer.

1. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.

N. Double-Check Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.

1. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.

O. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm (0.19-L/s) flow and applications with up to 10-foot head of water (30-kPa) back pressure. Include two check valves; intermediate atmospheric vent; and nonremovable, ASME B1.20.7, garden-hose threads on outlet.

P. Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

2.3 DISHWASHER AIR-GAP FITTINGS

A. Description: ASSE 1021, fitting suitable for use with domestic dishwashers and for deck mounting; with plastic body, chrome-plated brass cover; and capacity of at least 5 gpm (0.32 L/s); and inlet pressure of at least 5 psig (35 kPa) at temperature of at least 140 deg F (60 deg C). Include 5/8-inch- (16-mm-) ID inlet and 7/8-inch- (22-mm-) ID outlet hose connections.

B. Hoses: Rubber and suitable for temperature of at least 140 deg F (60 deg C).

1. Inlet Hose: 5/8-inch- (16-mm-) ID and 48 inches long.
2. Outlet Hose: 7/8-inch- (22-mm-) ID and 48 inches long.

2.4 WATER REGULATORS

A. Available Manufacturers:
1. Cla-Val Co.
2. Conbraco Industries, Inc.
3. Watts Industries, Inc.; Water Products Div.
4. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE 1003, water regulators, rated for initial working pressure of 150 psig (1035 kPa) minimum. Include integral factory-installed or separate field-installed, Y-pattern strainer.

1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.

a. General-Duty Service: Single-seated, direct operated, unless otherwise indicated.
b. Booster Heater Water Supply: Single-seated, direct operated with integral bypass.

2. NPS 2-1/2 (DN 65) and Larger: Bronze or cast-iron body with flanged ends. Include AWWA C550 or FDA-approved, interior epoxy coating for regulators with cast-iron body.

a. Type: Single-seated, direct operated.
b. Type: Pilot-operated, single- or double-seated, cast-iron-body main valve, with bronze-body pilot valve.

3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.

2.5 BALANCING VALVES

A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.

1. Available Manufacturers:

    a. Amtrol, Inc.
    b. Flow Design, Inc.
    c. ITT Industries; Bell & Gossett Div.
    d. Watts Industries, Inc.; Water Products Div.

2. NPS 2 (DN 50) and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
3. NPS 2 (DN 50) and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
4. NPS 2-1/2 (DN 65) and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.

B. Memory-Stop Balancing Valves, NPS 2 (DN 50) and Smaller: MSS SP-110, ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include two-piece, copper-alloy body with standard or full-port, chrome-plated brass ball, replaceable seats and seals, threaded or solder-joint ends, and vinyl-covered steel handle with memory-stop device.

1. Available Manufacturers:

    a. Conbraco Industries, Inc.
    b. Crane Co.
    c. Grinnell Corporation.
    d. Hammond Valve.
    e. Milwaukee Valve Company.
    f. NIBCO INC.
    g. Red-White Valve Corp.

2.6 THERMOSTATIC WATER MIXING VALVES

A. Manufacturers:
1. Bradley.
2. Lawler Manufacturing Company, Inc.
3. Leonard Valve Company.
4. Powers.
5. Symmons Industries, Inc.
6. T & S Brass and Bronze Works, Inc.

B. General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and thermometer. Refer to plumbing schedules for further information.

2.7 WATER TEMPERING VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Heat-Timer Corporation.
2. Holby Valve Co., Inc.
3. Sparco, Inc.
4. Watts Industries, Inc.; Water Products Div.

C. General: Manually adjustable, thermostatically controlled water tempering valve; bronze body; and adjustable temperature setting.

D. System Water Tempering Valves: Piston or discs controlling both hot- and cold-water flow, capable of limited antiscald protection. Include threaded inlets and outlet.

1. Finish: [**Rough bronze**] [**Chrome plated**].

E. Limited-Volume, Water Tempering Valves: Solder-joint inlets and NPS 3/4 (DN 20) maximum outlet.

2.8 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch (1.2-mm) round perforations, unless otherwise indicated.

1. Pressure Rating: 125-psig (860-kPa) minimum steam working pressure, unless otherwise indicated.
2. NPS 2 (DN 50) and Smaller: Bronze body, with female threaded ends.
3. NPS 2-1/2 (DN 65) and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.
4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.

a. Drain: Factory- or field-installed, hose-end drain valve.

2.9 OUTLET BOXES

A. Available Manufacturers:

1. Acorn Engineering Company.
2. Gray, Guy Manufacturing Co., Inc.
3. Oatey.
4. Symmons Industries, Inc.
5. Zurn Industries, Inc.; Jonespec Div.

B. General: Recessed-mounting outlet boxes with supply fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections, and wood-blocking reinforcement.

C. Clothes Washer Outlet Boxes: With hot- and cold-water hose connections and drain. Refer to plumbing schedules for further information.

D. Icemaker Outlet Boxes: With hose connection. Refer to plumbing schedules for further information.

E. Reinforcement: 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking between studs. Fire-retardant-treated-wood blocking is specified in Division 6 Section "Rough Carpentry."

2.10 HOSE STATIONS

A. Available Manufacturers:
1. Leonard Valve Company.
2. Strahman Valves, Inc.
3. T & S Brass and Bronze Works, Inc.

B. General: Assembly with fitting complying with ASME A112.18.1M and hose-connection outlet with threads complying with ASME B1.20.7. Refer to plumbing schedules for further information.

2.11 KEY-OPERATION HYDRANTS

A. Available Manufacturers:

1. Josam Co.
2. Simmons Manufacturing Co.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Industries, Inc.
6. Woodford Manufacturing Co.
7. Zurn Industries.

B. General: ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig (860 kPa). Refer to plumbing schedule for further information.

2.12 WHEEL-HANDLE WALL HYDRANTS

A. Available Manufacturers:
1. B & K Industries, Inc.
2. NIBCO INC.
3. Sioux Chief Manufacturing Co., Inc.
4. Watts Industries, Inc.; Water Products Div.
5. Woodford Manufacturing Co.
6. Zurn Industries, Inc.; Jonespec Div.

B. Refer to plumbing schedule for further information.

2.13 NONDRAINING NONFREEZE POST HYDRANTS

A. General: All-metal lever operation with nondraining water-storage reservoir, designed without drain and to be freezeproof with components of at least length required for burial of valve and water storage reservoir below frost line. Refer to plumbing schedule for further information.

2.14 TRAP SEAL PRIMER VALVES

A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:

1. Available Manufacturers:
   a. Josam Co.
   b. MIFAB Manufacturing, Inc.
   c. Precision Plumbing Products, Inc.
   d. Smith.
   e. Wade.
   f. Watts Industries, Inc.
   g. Zurn Industries.

2. 125-psig (860-kPa) minimum working pressure.
3. Bronze body with atmospheric-vented drain chamber.
4. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type Trap Seal Primer Valves: ASSE 1044, fixture-trap, waste-drainage-fed type, with the following characteristics:

1. Chrome-plated, cast-brass, NPS 1-1/4 (DN 32) minimum, lavatory P-trap with NPS 3/8 (DN 10) minimum, trap makeup connection.

C. Trap Seal Primer System: Factory-fabricated, automatic-operation assembly for wall mounting with the following:

1. Piping: NPS 3/4, ASTM B 88, Type L (DN 20, ASTM B 88M, Type B); copper, water tubing inlet and manifold with number of NPS 1/2 (DN 15) outlets as indicated.
2. Cabinet: Steel box with stainless-steel cover.
3. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
4. Water Hammer Arrester: ASSE 1010.
5. Vacuum Breaker: ASSE 1001.

2.15 DRAIN VALVES

A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 (DN 20) ball valve, rated for 400-psig (2760-kPa) minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

1. Inlet: Threaded or solder joint.
2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.

B. Hose-End Drain Valve: MSS SP-80, gate valve, Class 125, ASTM B 62 bronze body, with NPS 3/4 (DN 20) threaded or solder-joint inlet and ASME B1.20.7, garden-hose threads on outlet and cap. Hose bibbs are prohibited for this application.

C. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig (1380-kPa) minimum CWP or MSS SP-80, Class 125, gate valve; ASTM B 62 bronze body, with NPS 1/8 (DN 6) side drain outlet and cap.

2.16 BACKWATER VALVES

A. Available Manufacturers:

1. Josam Co.
2. Smith, Jay R. Mfg. Co.
3. Watts Industries, Inc.; Drainage Products Div.
4. Zurn Industries, Inc.; Specification Drainage Operation.

B. Horizontal Backwater Valves: ASME A112.14.1, cast-iron body, with removable bronze swing-check valve and threaded or bolted cover.

1. Closed-Position Check Valve: Factory assembled or field modified to hang closed unless subject to backflow condition.
2. Open-Position Check Valve: Factory assembled or field modified to hang open for airflow.

3. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor, instead of cover.

C. Drain Outlet Backwater Valves: Cast-iron or bronze body, with removable ball float, threaded inlet, and threaded or spigot outlet for installation in bottom outlet of floor drain.

2.17 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.

1. Available Manufacturers:

a. Josam Co.
b. Smith, Jay R. Mfg. Co.
c. Tyler Pipe; Wade Div.
d. Zurn Industries, Inc.; Specification Drainage Operation.

B. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

1. Available Manufacturers:
a. Josam Co.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Watts Industries, Inc.
e. Zurn Industries, Inc.

C. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig (860 kPa); integral nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.

1. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
2. Finish for Service Areas: Rough bronze.
3. Finish for Finished Rooms: Chrome or nickel plated.
4. Operation for Equipment Rooms: Wheel handle or operating key.
5. Operation for Service Areas: Operating key.
6. Operation for Finished Rooms: Operating key.
7. Include operating key with each operating-key hose bibb.
8. Include wall flange with each chrome- or nickel-plated hose bibb.

D. Air Vents: Float type for automatic air venting.

1. Bolted Construction: Bronze body with replaceable, corrosion-resistant metal float and stainless-steel mechanism and seat; threaded NPS 3/8 (DN 10) minimum inlet; 125-psig (860-kPa) minimum pressure rating at 140 deg F (60 deg C); and threaded vent outlet.
2. Welded Construction: Stainless-steel body with corrosion-resistant metal float, stainless-steel mechanism and seat, threaded NPS 3/8 (DN 10) minimum inlet, 150-psig (1035-kPa) minimum pressure rating, and threaded vent outlet.

E. Air-Admittance Valves: Plastic housing with mechanical-operation sealing diaphragm, designed to admit air into drainage and vent piping and to prevent transmission of sewer gas into building.

1. Available Manufacturers:

a. B & K Industries, Inc.
b. IPS Corporation.
c. J & B Products.
d. Oatey.
e. Sioux Chief Manufacturing Co., Inc.

2. Stack Vent Valve: ASSE 1050, designed for installation as terminal on soil, waste, and vent stacks, instead of stack vent extending through roof, in NPS 2 to NPS 4 (DN 50 to DN 100).
3. Fixture Vent Valve: ASSE 1051, designed for installation on waste piping, instead of vent connection, for single fixture, in NPS 1-1/4 to NPS 2 (DN 32 to DN 50).

F. Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft., 0.0625-inch-thick, lead flashing collar and skirt extending at least 8 inches from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

1. Available Manufacturers:
2. Manufacturers:

a. Acorn Engineering Company; Elmdor/Stoneman Div.

3. Open-Top Vent Cap: Without cap.
4. Low-Silhouette Vent Cap: With vandal-proof vent cap.
5. Extended Vent Cap: With field-installed, vandal-proof vent cap.

G. Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting, joined with ASTM C 564, rubber gaskets.

H. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.

1. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
2. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

I. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

J. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

K. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

L. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.

M. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

N. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

O. Downspout Boots: ASTM A 48 (ASTM A 48M), gray-iron casting, with NPS 4 (DN 100) outlet; shop-applied bituminous coating; and inlet size to match downspout.

P. Downspout Boots: ASTM A 74, Service class, hub-and-spigot, cast-iron soil pipe.

Q. Conductor Nozzles: Bronze body with threaded inlet for connected conductor size, and bronze wall flange with mounting holes.

1. Finish: Nickel bronze.

2.18 SLEEVE PENETRATION SYSTEMS

A. Available Manufacturers:

1. ProSet Systems, Inc.

B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.

1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
2. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.

    a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.19 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Copper Sheet: ASTM B 152 (ASTM B 152M), of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
2. Vent Pipe Flashing: 8 oz./sq. ft. (2.5 kg/sq. m or 0.27-mm thickness).

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.20 CLEANOUTS

A. Cleanouts,: Comply with ASME A112.3.1.

1. Application: Floor cleanout and wall cleanout.

2. Manufacturer:

    a. Josam Co.
    b. Smith.
    c. Wade.
    d. Zurn.
3. Refer to Plumbing Schedule for Specification Standards.

2.21 FLOOR DRAINS

A. Floor Drains,: Comply with ASME A112.3.1.

1. Application: Floor drain.
2. Manufacturer:

    a. Josam Co.
    b. MiFab.
    c. Smith.
    d. Wade Div.
    e. Zurn Industries.
3. Refer to Plumbing Schedule for Specification Standards.

2.22 TRENCH DRAINS

A. Trench Drains: Comply with ASME A112.3.1.
1. Manufacturer:

    a. Josam Co.
    b. Smith.
    c. Wade Div.
    d. Zurn Industries.
2. Refer to Plumbing Schedule for Specification Standards.

2.23 ROOF DRAINS

A. Roof Drains,: Comply with ASME A112.3.1.

1. Application: Roof drain.
2. Manufacturer:

    a. Josam Co.
    b. Smith.
    c. Wade Div.
    d. Zurn Industries.
3. Refer to Plumbing Schedule for Specification Standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

D. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.

E. Install draining-type ground and ground post hydrants with 1 cu. yd. of crushed gravel around drain hole.

1. Set ground hydrants with box flush with grade.
2. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.

F. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

G. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

H. Install expansion joints on vertical risers, stacks, and conductors if indicated.

I. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

J. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

K. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

L. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

M. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

N. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
    b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
    c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

O. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.

P. Install interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.

2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
5. Coordinate oil-interceptor storage tank and gravity drain with Division 2 Section "Fuel-Oil Distribution."

Q. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

R. Fasten recessed-type plumbing specialties to reinforcement built into walls.

S. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

T. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

U. Install air vents at piping high points. Include ball, gate, or globe valve in inlet.

V. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

W. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 15 Sections.

D. Ground equipment.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

F. Connect plumbing specialties and devices that require power according to Division 16 Sections.

G. Interceptor Connections: Connect piping, flow-control fittings, and accessories.

1. Grease Interceptors: Connect inlet and outlet to unit, and flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.
2. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.
3. Solids Interceptors: Connect inlet and outlet.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer thermostatic water mixing valve water tempering valve grease interceptor and oil interceptor.

1. Text: Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
2. Refer to Division 15 Section "Basic Mechanical Materials and Methods Mechanical Identification" for nameplates and signs.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain equipment. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 15430

SECTION 15738 - SPLIT-SYSTEM AIR-CONDITIONING UNITS

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 split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

B. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 7 Section "Roof Accessories."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion on compressors.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set of filters for each unit.

2. Fan Belts: One set of belts for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Air Conditioning.

2. Lennox Industries.

3. McQuay Air Conditioning.

4. Trane Company.

5. York International.

2.2 EVAPORATOR-FAN COMPONENTS (FIVE TONS AND BELOW)

A. Cabinet: Enameled steel with removable panels on front and ends in manufacturer standard color.

1. Insulation: 1” high density, R 4.2.

2. Drain Pans: Polycorbonate, with connection for drain; insulated.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors;

manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.

D. Fan: Centrifugal, FC.

E. Fan Motors: ECM type, pressure independent, soft start.

F. Filters: Disposable 2" pleated media.

2.3 EVAPORATOR-FAN COMPONENTS (ABOVE FIVE TONS)

A. Cabinet: Enameled steel with removable panels on front and ends in manufacturer standard color.

1. Insulation: ½", fire-retardant with antimicrobial coating.

2. Drain Pans: PVC, with connection for drain; insulated.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.

D. Fan: Belt drive, centrifugal FC.

E. Fan Motors: Manufacturer's standards with internal thermal overload protection or circuit breaker.

F. Filters: Disposable, 2" pleated media.

2.4 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS (FIVE TONS AND BELOW)

A. Casing: Galvanized steel, finished with baked enamel in manufacturer-standard color, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Scroll.

2. Rubber vibration isolator mounting.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240.

D. Fan: Propeller type, directly connected to motor.

E. Motor: Permanently lubricated, totally enclosed with integral thermal-overload protection.

2.5 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS (ABOVE FIVE TONS)

A. Casing: Galvanized steel, finished with baked enamel in manufacturer-standard color, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide heavy gauge perimeter base rail for lifting. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Semi-hermetic or hermetically sealed as scheduled with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Reciprocating or scroll as scheduled.

2. Rubber vibration isolator mounting.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler. Provide flexible epoxy polymer coating uniformly to coil. Pre-coated fin stock is not acceptable.

D. Fan: Propeller type, directly connected to motor.

E. Motor: Permanently lubricated, with integral thermal-overload protection.

2.6 ACCESSORIES

A. Thermostat: Low voltage 7-day, programmable with subbase to control compressor and evaporator fan.

1. Compressor time delay.

2. 24-hour time control of system stop and start.

3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.

4. Fan-speed selection, including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounting, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

D. Install ground-mounting, compressor-condenser components on polyethylene mounting base.

E. Install roof-mounting compressor-condenser components on equipment supports specified in Division 7 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

F. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch. Refer to Division 15 Section "Mechanical Vibration Controls and Seismic Restraints."

G. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Install piping adjacent to unit to allow service and maintenance.

B. Duct Connections: Duct installation requirements are specified in Division 15 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 15 Section "Duct Accessories."

C. Ground equipment according to Division 16 Section "Grounding and Bonding."

D. Electrical Connections: Comply with requirements in Division 16 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION

SECTION 15815 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal Ductwork.
2. Nonmetal ductwork.
3. Casing and plenums.
4. Kitchen hood ductwork.
5. Dishwasher exhaust ductwork.
6. Hangers and supports.

B. References:

1. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 1997a.
2. ASTM A 366/A 366M - Standard Specification for Commercial Steel (CS) Sheet, Carbon, (0.15 Maximum Percent) Cold Rolled; 1997.
3. ASTM A 569/A 569M - Standard Specification for Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial; 1998.
4. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 1998.
5. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; 1996.
6. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 1996.
7. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 1994.
8. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; latest Edition.
9. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; 1996.

1.3 PERFORMANCE REQUIREMENTS

A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", latest edition and NFPA 90A.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Duct Construction Standards (DCS) for each pressure class required for this project. DCS shall include transverse and longitudinal joint type, any internal or external reinforcement and sheetmetal thickness and size for each pressure class.
4. Flexible duct manufacturer, type and product details.
5. Flexible connection materials and connection types.
6. Fitting fabrication details.
7. Damper details.
8. Description of hanger types and sizes for duct sizes used in this project. Hangers must comply with the latest edition of SMACNA's "HVAC Duct Construction Standards - Metal and Flexible". Hanger submittal should include hanger spacing to be used.

B. Coordination Drawings: Provide drawings indicating fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work. Minimum scale of ¼” = 1’0”. Coordinate duct location with other trades.

C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of documented experience.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Construct with a radius of not less than 1-1/2 times width of duct on centerline. Where not possible, provide a centerline radius of 1.0 times the width of duct. Where space constraints will not allow a centerline radius of 1.0 times the width of duct, provide rectangular elbows with double wall (airfoil) factory fabricated turning vanes installed on vane runner rails. Turning vanes shall not be used in bends other than 90 degrees.

1. Branch connections shall be 45 degree entry fittings.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. McGill AirFlow LLC.
2. SPOT
3. SEMCO

B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated. If duct is exposed to the weather, provide a continuous sheetmetal hat channel over all transverse joints and position openings in longitudinal seams facing in the direction of possible water flow. Provide a flexible, adhesive aluminum jacket designed for this application over entire duct surface per manufacturer's recommendations.

D. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.
5. Insulation thickness to be 2 inches.

E. Inner Duct: Minimum 0.028-inch (0.7-mm) solid sheet steel.

2.3 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. SPOT

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 36 Inches (1524 mm) in Diameter: Flanged.

D. Longitudinal Seams: Round and flat oval duct must be spiral seam ductwork. Longitudinal seam snap-lock duct will not be allowed.

E. Tees, Laterals and Bends: Fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Elbows and bends: Construct with a radius of not less than 1-1/2 times width of duct on centerline. Where not possible, provide a centerline radius of 1.0 times the width of duct. Elbows shall be of gored, pleated or stamped construction. 90 degree bends shall be a minimum of 5-gore. 45 degree bends shall be a minimum of 3 gore. Adjustable elbows will not be allowed.

2. Branch connections shall be conical, 45 deg. entry or lateral fittings.

2.4 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. SPOT

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

a. Transverse Joints in Ducts Larger Than 36 Inches (1524 mm) in Diameter: Flanged.

2. Longitudinal Seams: Round and flat oval duct must be spiral seam ductwork. Longitudinal seam snap-lock duct will not be allowed.

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. Elbows and bends: Construct with a radius of not less than 1-1/2 times width of duct on centerline. Where not possible, provide a centerline radius of 1.0 times the width of duct. Elbows shall be of gored, pleated or stamped construction. 90 degree bends shall be a minimum of 5-gore. 45 degree bends shall be a minimum of 3 gore. Adjustable elbows will not be allowed.
    b. Branch connections shall be conical, 45 deg. entry or lateral fittings.

D. Inner Duct: Minimum 0.028-inch (0.7-mm) solid sheet steel.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: [0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K)] at 75 deg F (24 deg C) mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

2.5 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Tie Rods: Galvanized steel, 3/8-inch (10-mm) minimum diameter.

2.6 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. CertainTeed Corporation; Insulation Group.
   b. Johns Manville.
   c. Knauf Insulation.
   d. Owens Corning.

2. Maximum Thermal Conductivity:

   a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
   b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F (0.033 W/m x K) at 75 deg F (24 deg C) mean temperature.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

   a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-)

diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-(0.41-mm-) thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).
7. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm (12.7 m/s) or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch (2.4-mm) diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.7 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.8 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.9 Insulated Flexible Ducts

2.10 Kitchen Exhaust Ducts

2.11 Dishwasher Exhaust Ducts

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 15 Section "Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet (6 m) in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches (38 mm) from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

A. Seal all duct according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. All duct: Seal Class A.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 15 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Ducts with a Pressure Class Higher Than 3-Inch wg (750 Pa): Test representative duct sections, selected by Engineer from sections installed**,** totaling no less than 25 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Underground Ducts: Concrete-encased, PVC-coated, galvanized sheet steel**.**

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive [1-inch wg (250 Pa)]
b. SMACNA Leakage Class for Rectangular: 12
c. SMACNA Leakage Class for Round and Flat Oval: 12

2. Ducts Connected to Constant-Volume Air-Handling Units:

a. Pressure Class: Positive 1-inch wg (500 Pa), or round up the ESP listed in the equipment schedules and provide, whichever is greater.
b. SMACNA Leakage Class for Rectangular: 12
c. SMACNA Leakage Class for Round and Flat Oval: 12

3. Ducts Connected to Variable-Air-Volume Air-Handling Units prior to terminal units:

a. Pressure Class: Positive 3-inch wg (750 Pa)
b. SMACNA Leakage Class for Rectangular: 12
c. SMACNA Leakage Class for Round and Flat Oval: 12

C. Return, toilet exhaust and outside air ducts:

1. Pressure Class: Positive or negative 1-inch wg (250 Pa).
2. SMACNA Leakage Class for Rectangular: 12
3. SMACNA Leakage Class for Round and Flat Oval: 12

D. Special Exhaust Ducts:

1. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

a. Exposed to View: Type 304, stainless-steel sheet.
b. Concealed: Type 304, stainless-steel sheet.
c. Welded seams and joints.
d. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
f. SMACNA Leakage Class: 3.
g. Minimum 18 gauge or thickness required per local code, whichever is greater

2. Ducts Connected to Dishwasher Hoods:

a. Type 304, stainless-steel sheet.
b. Welded seams and flanged joints with watertight EPDM gaskets.

c. Pressure Class: Positive or negative 2-inch wg (500 Pa).
d. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
e. SMACNA Leakage Class: 3.
f. Minimum 18 gauge or thickness required per local code, whichever is greater

E. Duct Exposed to View

1. Supply Air Ducts: shall be double wall spiral round construction with 1” thick insulation in conditioned spaces and 2” insulation in unconditioned spaces.
2. Return and Exhaust Air Ducts: shall be un-insulated single wall spiral round construction in conditioned spaces and double wall round construction with 1” insulation in unconditioned spaces.

END OF SECTION 15815

SECTION 15820 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Combination fire and smoke dampers.
7. Turning vanes.
8. Duct-mounting access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.
12. Louvers.

B. Related Sections include the following:

1. Division 13 Section "Fire Alarm" for duct-mounting fire and smoke detectors.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Combination fire and smoke dampers.
7. Turning vanes.
8. Duct-mounting access doors.

9. Flexible connectors.
10. Flexible ducts.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.
2. Manual-volume damper installations.
3. Motorized-control damper installations.
4. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
5. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

D. Aluminum Sheets: ASTM B 209 (ASTM B 209M), alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063, temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 BACKDRAFT DAMPERS

A. Manufacturers:
1. CESCO Products.
2. Greenheck.
3. Ruskin Company.

B. Description: Multiple-blade, parallel action gravity balanced, with blades of maximum 6-inch (150-mm) width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Frame: 20 gauge, galvanized sheet steel, with welded corners and mounting flange.

D. Blades: 0.025-inch- thick, roll-formed aluminum.

E. Blade Seals: Vinyl.

F. Blade Axles: Stainless Steel.

G. Tie Bars and Brackets: Galvanized steel.

H. Basis of Design: Ruskin S3G.

2.4 VOLUME DAMPERS

A. Manufacturers:
1. Flexmaster U.S.A., Inc.
2. METALAIRE, Inc.
3. Nailor Industries Inc.
4. Ruskin Company.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 2-Inch wg (750 Pa) or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 22 gauge thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Single Skin Steel Blades: 22 gauge, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Bearings: Molded synthetic.
5. Tie Bars and Brackets: Aluminum.
6. Tie Bars and Brackets: Galvanized steel.
7. Basis of Design: Ruskin MD 15 (rectangular) and MDRS25 (round).

D. Jackshaft: 1-inch- (25-mm-) diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 MOTORIZED CONTROL DAMPERS

A. Manufacturers:
   1. CESCO Products.
   2. Greenheck.
   3. METALAIRE, Inc.
   4. Nailor Industries Inc.
   5. Ruskin Company.

B. General Description: AMCA-rated, parallel (return air applications) or opposed (outside air applications) blade design; minimum of 16 gauge thick, galvanized-steel frames with holes for duct mounting; minimum of 16 gauge thick, galvanized-steel damper blades with maximum blade width of 8 inches (203 mm).

   1. Secure blades to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
   2. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
   3. Provide closed-cell neoprene edging rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 1-inch wg; when tested according to AMCA 500D.

C. Basis of Design: Ruskin CD35.

2.6 FIRE DAMPERS

A. Manufacturers:
   1. CESCO Products.
   2. Greenheck.
   3. METALAIRE, Inc.
   4. Nailor Industries Inc.
   5. Ruskin Company.

B. Fire dampers shall be labeled according to UL 555.

C. Fire Rating: 1-1/2 hours (3 hours as noed).

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 20 gauge galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
   1. Minimum Thickness: 20 gauge frame complies with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: 24 gauge, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Fusible Links: Replaceable, 165 deg F rated.

J. Basis of Design: 1-1/2 hour – Ruskin 1BD2-B (rectangular) and FDR25 (round), 3 hour – Ruskin 1BD2-B3 (rectangular)

2.7 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
1. CESCO Products.
2. Greenheck.
3. Nailor Industries Inc.
4. Ruskin Company.

B. General Description: Labeled according to UL 555S. Combination fire and smoke dampers shall be labeled according to UL 555 for 1-1/2-hour rating.

C. Fusible Links: Replaceable, 165 deg F rated.

D. Frame and Blades16 gauge, galvanized sheet steel.

E. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application.

F. Damper Motors: Modulating and two-position action.

1. Comply with requirements in Division 15 Section "Motors."
2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
4. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
5. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
6. Electrical Connection: 115 V, single phase, 60 Hz.

G. Basis of Design: Ruskin FSD376.

2.8 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- (38-mm-) wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch (19 mm) o.c.; support with bars perpendicular to blades set 2 inches (50 mm) o.c.; and set into vane runners suitable for duct mounting.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.9 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.

1. Manufacturers:
   a. CESCO Products.
   b. Flexmaster U.S.A., Inc.
   c. Greenheck.
   d. Nailor Industries Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

   a. Less Than 12 Inches (300 mm) Square: Secure with two sash locks.
   b. Up to 18 Inches (450 mm) Square: Two hinges and two sash locks.
   c. Up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches.
   d. Sizes 24 by 48 Inches (600 by 1200 mm) and Larger: One additional hinge.

C. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

D. Insulation: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

2.11 INSULATED ACOUSTICAL MEDIUM PRESSURE FLEXIBLE DUCT

A. Where flexible duct is shown on drawings, provide Flexmaster Type 8M UL 181 Class I Air Duct or equal.

B. The duct shall be constructed of a CPE fabric supported by helical wound galvanized steel. The fabric shall be mechanically locked to the steel helix without the use of adhesives or chemicals.

C. The internal working pressure rating shall be at least 6” w.g. positive and 4” w.g. negative with a bursting pressure of at least 2 ½ time the working pressure

D. The duct shall be rated for a velocity of at lease 4000 feet per minute.

E. The duct must be suitable for continuous operation at a temperature range of -20° F to +250° F.

F. Acoustical performance, when tested by an independent laboratory in accordance with the Air Diffusion Council’s Flexible Air Duct Test Code FD 72-R1, Section 3.0, Sound Properties, shall be as follows:

1. The insertion loss (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be at least:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	7	31	40	38	40	27
8" diameter	13	29	36	35	38	22
12" diameter	21	28	29	33	26	12

2. The radiated noise reduction (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be at least:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	5	8	7	8	11	15
8" diameter	10	7	7	8	10	13
12" diameter	9	6	6	5	9	13

3. The self generated sound power levels (LW) dB re 10^{-12} Watt of a 10 foot length of straight duct for an empty sheet metal duct when tested in accordance with ASTM E477, at a velocity of 1000 feet per minute, shall not exceed:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	42	31	23	18	17	21

8” diam-eter	41	34	27	19	18	21
12” di-ameter	54	45	38	31	27	23

G. Factory insulate the flexible duct with fiberglass insulation. Provide insulation as required by ASHRAE 90.1.

H. Cover the insulation with a fire retardant metalized vapor barrier jacket reinforced with crosshatched scrim having a permeance of not greater than 0.05 perms when tested in accordance with ASTM #96, Procedure A.

2.12 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.13 LOUVERS

A. Manufacturers:
   1. Ruskin
   2. Greenheck

B. Description: Stationary-type louver with blades designed to prevent the penetration of wind driven rain.
   1. Extended sill to drain water to building exterior.
   2. Extruded aluminum alloy as follows:
      a. 5” deep frame with 0.081” wall thickness.
      b. Blades shall be double drainable and sight proof.
      c. Provide with aluminum screen.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

E. Provide test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.

G. Install duct silencers independent of ducts with flexible duct connectors, lagged with loaded vinyl sheet on inlets and outlets where indicated.

H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot (15-m) spacing.
5. On sides of ducts where adequate clearance is available.

I. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body Plus Ladder Access: 25 by 17 inches (635 by 430 mm).

J. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches (200 mm) in diameter.
2. Two-Hand Access: 10 inches (250 mm) in diameter.
3. Head and Hand Access: 12 inches (300 mm) in diameter.
4. Head and Shoulders Access: 18 inches (460 mm) in diameter.
5. Body Access: 24 inches (600 mm) in diameter.

K. Label access doors according to Division 15 Section "Mechanical Identification."

L. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

M. For fans developing static pressures of 5-inch wg (1250 Pa) and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect terminal units to supply ducts directly or with maximum 12-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.

O. Connect diffusers or light troffer boots to low pressure ducts with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.

P. Connect flexible ducts to metal ducts with draw bands.

Q. Install duct test holes where indicated and required for testing and balancing purposes.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 15820

SECTION 15838 - POWER VENTILATORS

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. Utility set fans.
2. Centrifugal roof ventilators.
3. Ceiling-mounting ventilators.
4. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on sea-level conditions.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material gages and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Coordination Drawings: Show roof penetration requirements and reflected ceiling plans drawn to scale and coordinating roof penetrations and units mounted above ceiling. Show the following:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Utility Set Fans:
   a. Cook, Loren Company.
   b. Greenheek.
   c. Penn Ventilation Companies, Inc.

2. Centrifugal Roof Ventilators:

   a. Acme Engineering & Mfg. Corp.
   b. Cook, Loren Company.
   c. Greenheck Fan Corp.
   d. Penn Ventilation Companies, Inc.

3. Ceiling-Mounting Ventilators:
   a. Broan Mfg. Co., Inc.
   b. Carnes Company HVAC.
   c. Cook, Loren Company.
   d. Greenheck Fan Corp.
   e. NuTone Inc.
   f. Penn Ventilation Companies, Inc.

4. In-Line Centrifugal Fans:

   a. Acme Engineering & Mfg. Corp.
   b. Cook, Loren Company.
   c. Greenheck Fan Corp.
   d. Penn Ventilation Companies, Inc.

2.2 UTILITY SET FANS

A. Description: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

B. Housing: Fabricated of galvanized with side sheets fastened with a deep lock seam or welded to scroll sheets.

1. Housing Discharge Arrangement: Adjustable to eight standard positions.

C. Fan Wheels: Single-width, single inlet; backward inclined aluminum wheel, with hub keyed to shaft.

1. Blade Materials: Aluminum.
2. Blade Type: Backward inclined.
3. Spark-Resistant Construction: AMCA 99.

D. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

E. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9, L_{50} of 200,000 hours.

F. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor: 1.5.
2. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with motors larger than 5 hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
3. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
4. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

G. Accessories:

1. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades and felt edges in steel frame installed on fan discharge.
2. Access Doors: Gasketed doors with latch-type handles.
3. Scroll Dampers: Single-blade damper installed at fan scroll top with adjustable linkage.
4. Inlet Screens: Removable wire mesh.
5. Drain Connections: NPS 3/4 (DN 20) threaded coupling drain connection installed at lowest point of housing.
6. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.

H. Coatings: Powder-baked enamel.

I. Basis of Design: Loren Cook Model “CPA”.

2.3 CENTRIFUGAL ROOF VENTILATORS

A. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain drain.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent for direct drive models.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: 13 1/2 inches.
3. Pitch Mounting: Manufacture curb for roof slope.

2.4 CEILING-MOUNTING VENTILATORS

A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
4. Isolation: Rubber-in-shear vibration isolators.

G. Basis of Design: Cook “Gemini”

2.5 IN-LINE CENTRIFUGAL FANS

A. Description: In-line, belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Driven Units: Motor encased in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:

1. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
2. Companion Flanges: For inlet and outlet duct connections.
3. Fan Guards: 1/2- by 1-inch (13- by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
4. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

G. Basis of Design: Cook Model “SQN”

2.6 MOTORS

A. Enclosure Type: Guarded dripproof.

2.7 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using spring isolators having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 15 Section "Mechanical Vibration Controls."

1. Secure vibration controls to concrete bases using anchor bolts cast in concrete base.

C. Install floor-mounting units on concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

D. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 7 Section "Roof Accessories" for installation of roof curbs.

E. Ceiling Units: Suspend units from structure.

F. Support suspended units from structure using threaded steel rods and spring hangers. Vibration-control devices are specified in Division 15 Section "Mechanical Vibration Controls."

G. Install units with clearances for service and maintenance.

H. Label units according to requirements specified in Division 15 Section "Mechanical Identification."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 Section "Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Equipment Startup Checks:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Verify lubrication for bearings and other moving parts.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
7. Disable automatic temperature-control operators.

B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.
2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

G. Replace fan and motor pulleys as required to achieve design airflow.

H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.5 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."
3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 15838

SECTION 15855 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Ceiling and wall mounted diffusers, registers, and grilles.

B. Related Sections:

   1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
   2. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

   1. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.

3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 Manufacturers:

A.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. METALAIRE, Inc.
   b. Price Industries.
   c. Titus.

2. Refer to drawings for air device accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 15855

SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Contractual Relationship
1. The scope of the TAB work as defined in this Section is indicated in order that the Contractor will be advised of the coordination, adjustment, and system modification which will be required under the project work in order to complete the requirements for final TAB. The TAB firm will not have a contractual relationship with the Mechanical Contractor, but will be responsible to the General Contractor for the satisfactory execution of the TAB work. **The General Contractor in his original bid shall include the costs required to cover all work which may be required in the TAB phases as defined herein and as may be necessary for the completion of the TAB work as defined by the TAB firm**.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.
b. Variable-air-volume systems.

2. Balancing Hydronic Piping Systems:
a. Primary-secondary hydronic systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 90 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

B. TAB Conference: Meet with Architect & Owner’s representative on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 15 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 15 Section "Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 15 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 15 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 15 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.9 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.10 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.

h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches (mm), and bore.
i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Filter static-pressure differential in inches wg (Pa).

f. Preheat-coil static-pressure differential in inches wg (Pa).
g. Cooling-coil static-pressure differential in inches wg (Pa).
h. Heating-coil static-pressure differential in inches wg (Pa).
i. Outdoor airflow in cfm (L/s).
j. Return airflow in cfm (L/s).
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch (mm) o.c.
f. Make and model number.
g. Face area in sq. ft. (sq. m).
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Water flow rate in gpm (L/s).
i. Water pressure differential in feet of head or psig (kPa).
j. Entering-water temperature in deg F (deg C).
k. Leaving-water temperature in deg F (deg C).
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig (kPa).
n. Refrigerant suction temperature in deg F (deg C).
o. Inlet steam pressure in psig (kPa).

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.

b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F (deg C).
d. Duct static pressure in inches wg (Pa).
e. Duct size in inches (mm).
f. Duct area in sq. ft. (sq. m).
g. Indicated air flow rate in cfm (L/s).
h. Indicated velocity in fpm (m/s).
i. Actual air flow rate in cfm (L/s).
j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

I. Air-Terminal-Device Reports:

1. Unit Data:

    a. System and air-handling unit identification.
    b. Location and zone.
    c. Apparatus used for test.
    d. Area served.
    e. Make.
    f. Number from system diagram.
    g. Type and model number.
    h. Size.
    i. Effective area in sq. ft. (sq. m).

2. Test Data (Indicated and Actual Values):

    a. Air flow rate in cfm (L/s).
    b. Air velocity in fpm (m/s).
    c. Preliminary air flow rate as needed in cfm (L/s).
    d. Preliminary velocity as needed in fpm (m/s).
    e. Final air flow rate in cfm (L/s).
    f. Final velocity in fpm (m/s).
    g. Space temperature in deg F (deg C).

J. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Service.
    d. Make and size.
    e. Model number and serial number.
    f. Water flow rate in gpm (L/s).
    g. Water pressure differential in feet of head or psig (kPa).
    h. Required net positive suction head in feet of head or psig (kPa).
    i. Pump rpm.
    j. Impeller diameter in inches (mm).
    k. Motor make and frame size.
    l. Motor horsepower and rpm.
    m. Voltage at each connection.
    n. Amperage for each phase.
    o. Full-load amperage and service factor.
    p. Seal type.

2. Test Data (Indicated and Actual Values):

    a. Static head in feet of head or psig (kPa).

b. Pump shutoff pressure in feet of head or psig (kPa).
c. Actual impeller size in inches (mm).
d. Full-open flow rate in gpm (L/s).
e. Full-open pressure in feet of head or psig (kPa).
f. Final discharge pressure in feet of head or psig (kPa).
g. Final suction pressure in feet of head or psig (kPa).
h. Final total pressure in feet of head or psig (kPa).
i. Final water flow rate in gpm (L/s).
j. Voltage at each connection.
k. Amperage for each phase.

K. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.12 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
c. Verify that balancing devices are marked with final balance position.
d. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Construction Manager.
3. Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of

the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

3.20 DUCT LEAKAGE TESTING

A. Contractor shall prepare ductwork for leakage testing by test and balance firm. Contractor shall remake any joints and/or duct runs which do not comply with maximum allowable leakage rates for retest by test and balance firm. Mechanical Contractor shall be responsible for any compensation due to the test and balance firm for additional testing required as a result of initial system failure.

B. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Test ductwork assemblies in excess of 1-1/2 inch static pressure class installed by Mechanical Contractor.
2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above

maximum design operating pressure. Give seven days' advance notice for testing.

3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (500 Pa) (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg (500 to 2500 Pa).

END OF SECTION 15950

SECTION 16051 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and

sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

END OF SECTION 16051

SECTION 16060 - GROUNDING AND BONDING

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 methods and materials for grounding systems and equipment.

1. Overhead-lines grounding.
2. Underground distribution grounding.
3. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

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

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. Grounding for sensitive electronic equipment.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the

InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches (6 by 50 mm) in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by10 feet (19 mm by 3 m) in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install barecopper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING OVERHEAD LINES

A. Comply with IEEE C2 grounding requirements.

B. Install 2 parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.

C. Drive ground rods until tops are 12 inches (300 mm) below finished grade in undisturbed earth.

D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.

E. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.

F. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.

G. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
10. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 2 Section "Underground Ducts and Utility Structures," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

B. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.
7. ohms.

D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 16060

SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

G. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.

H. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

I. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high letters on 20-inch (500-mm) centers.

D. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

2.7 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.9 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch (5 mm).

2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 9 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trenchexceeds 16 inches (400 mm) overall.

J. Painted Identification: Comply with requirements in Division 9 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot (3-m) maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
1. Power.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

F. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

G. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

J. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Power transfer switches.
    b. Controls with external control power connections.

L. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

M. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchgear.
    e. Switchboards.
    f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    g. Enclosed switches.
    h. Enclosed circuit breakers.
    i. Enclosed controllers.

j. Push-button stations.
k. Contactors.

END OF SECTION 16075

SECTION 16120 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

B. Related Sections include the following:

1. Division 16 Section "Voice and Data Communication Cabling" for cabling used for voice and data circuits.
2. Division 16 Section "Undercarpet Cables" for flat cables for undercarpet installations.
3. Division 16 Section "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

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

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. 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. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. Encore Wire
4. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN SO.

D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.4 SLEEVE SEALS

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. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

F. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

I. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

J. Branch Circuits in Cable Tray: Type THHN-THWN, single conductors in raceway.

K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

L. Class 1 Control Circuits: Type THHN-THWN, in raceway.

M. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 16 Section "Electrical Supports and Seismic Restraints."

F. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 7 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 7 Section "Through-Penetration Firestop Systems."

K. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 7 Section "Through-Penetration Firestop Systems."

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 16120

SECTION 16130 - RACEWAYS AND BOXES

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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 2 Section "Underground Ducts and Utility Structures" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
   1. For handholes and boxes for underground wiring, including the following:

      a. Duct entry provisions, including locations and duct sizes.
      b. Frame and cover design.
      c. Grounding details.
      d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
      e. Joint details.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

   1. Structural members in the paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

   3. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   4. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: For professional engineer and testing agency.

E. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

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. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. EMT: ANSI C80.3.

F. FMC: Zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket.

H. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: , set-screw type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

I. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

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. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

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. Arnco Corporation.
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

B. Description: Comply with UL 2024; flexible type, approved for plenum installation.

2.4 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

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. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

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. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

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. Manufacturing Company; Walker Division.
    b. Enduro Systems, Inc.; Composite Products Division.
    c. Hubbell Incorporated; Wiring Device-Kellems Division.
    d. Lamson & Sessions; Carlon Electrical Products.
    e. Panduit Corp.
    f. Walker Systems, Inc.; Wiremold Company (The).
    g. Wiremold Company (The); Electrical Sales Division.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.

F. Nonmetallic Floor Boxes: Nonadjustable, round.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.

J. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Green.
2. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, as indicated for each service.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

8. 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. Armorcast Products Company.
b. Carson Industries LLC.
c. CDR Systems Corporation.
d. NewBasis.

B. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

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. Armorcast Products Company.
    b. Carson Industries LLC.
    c. Christy Concrete Products.
    d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.

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. Carson Industries LLC.
    b. Christy Concrete Products.
    c. Nordic Fiberglass, Inc.

2.9 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.10 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: Rigid steel conduit.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 16 Section "Electrical Supports and Seismic Restraints."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
4. Use insulating bushings to protect wiring.

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
    d. Attics: 135 deg F (75 deg C) temperature change.
    e. Insert location and corresponding temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

P. Set metal floor boxes level and flush with finished floor surface.

Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 2 Section "Earthwork."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes and boxes with bottom below the frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.8 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 16130

SECTION 16140 - WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Isolated-ground receptacles.
4. Snap switches and wall-box dimmers.
5. Hospital-grade receptacles.
6. Wall-switch and exterior occupancy sensors.
7. Communications outlets.
8. Pendant cord-connector devices.
9. Cord and plug sets.
10. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

B. Related Sections include the following:

1. Division 16 Section "Voice and Data Communication Cabling" for workstation outlets.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; 5351 (single), 5352 (duplex).
      b. Hubbell; HBL5351 (single), CR5352 (duplex).
      c. Leviton; 5891 (single), 5352 (duplex).
      d. Pass & Seymour; 5381 (single), 5352 (duplex).

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Hubbell; CR 5253IG.
      b. Leviton; 5362-IG.
      c. Pass & Seymour; IG6300.

   2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   2. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; GF20.
      b. Pass & Seymour; 2084.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:

      a. Cooper; L520R.

b. Hubbell; HBL2310.
c. Leviton; 2310.
d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; IG2310.
b. Leviton; 2310-IG.

2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Key-Operated Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.

3. Description: Single pole, with factory-supplied key in lieu of switch handle.

D. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; 1995.
    b. Hubbell; HBL1557.
    c. Leviton; 1257.
    d. Pass & Seymour; 1251.

E. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
    1. Products: Subject to compliance with requirements, provide one of the following:

        a. Cooper; 1995L.
        b. Hubbell; HBL1557L.
        c. Leviton; 1257L.
        d. Pass & Seymour; 1251L.

2.6 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.7 COMMUNICATIONS OUTLETS

A. Telephone Outlet:
    1. Products: Subject to compliance with requirements, provide one of the following:

        a. Cooper; 3560-6.
        b. Leviton; 40649.

    2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

    1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 3562.
b. Leviton; 40595.

3. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

2.8 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant thermoplastic with lockable cover.

2.9 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 16140

SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
5. Retain subparagraph below if final system short-circuit and coordination studies will be performed by the designer or will be assigned to an independent consultant. These curves are also beneficial to Owner for future additions or reevaluations of settings of overcurrent protective devices. Although some

manufacturers no longer offer curves on translucent graph paper, curves can normally be downloaded from manufacturers' Web sites or be obtained, in electronic form, from various coordination software vendors as part of a subscription service. Retain option in subparagraph below only if manufacturers selected offer

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen Areas: NEMA 250, Type 4X,.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 16 Section "Electrical Identification."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 16410

SECTION 16442 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.
4. Electronic-grade panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

1.5 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
    b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

1.9 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Kitchen Areas: NEMA 250, Type 4X,.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
5. Finishes:

a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

6. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
5. Split Bus: Vertical buses divided into individual vertical sections.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

G. Branch Overcurrent Protective Devices: Fused switches.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

2.4 ELECTRONIC-GRADE PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. Siemens Energy & Automation, Inc.
3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1; with factory-installed, integral TVSS; labeled by an NRTL for compliance with UL 67 after installing TVSS.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

E. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.

F. Buses:

1. Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
2. Copper equipment and isolated ground buses.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 3 Section "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."

E. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

J. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 16 Section "Electrical Identification."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 16 Section"Electrical Identification."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 16 Section "Electrical Identification."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 16 Section "Overcurrent Protective Device Coordination."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 16442

SECTION 16511 - INTERIOR LIGHTING

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. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.
5. Retrofit kits for fluorescent lighting fixtures.

B. Related Sections include the following:

1. Division 13 Section "Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
2. Division 16 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
3. Division 16 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
4. Division 16 Section "Stage Lighting" for theatrical lighting fixtures and their controls.
5. Division 16 Section "Dimming Controls" for architectural dimming systems.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast.
4. Energy-efficiency data.
5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article in Division 15 Section "Diffusers, Registers, and Grilles."
6. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 15 Section "Diffusers, Registers, and Grilles."
7. Life, output, and energy-efficiency data for lamps.
8. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
    b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Wiring Diagrams: Power and control wiring.

C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Structural members to which suspension systems for lighting fixtures will be attached.
4. Other items in finished ceiling including the following:

a. Air outlets and inlets.
b. Speakers.
c. Sprinklers.
d. Smoke and fire detectors.
e. Access panels.

5. Perimeter moldings.

D. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:

1. Lamps: Specified units installed.
2. Accessories: Cords and plugs.

E. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.

F. Qualification Data: For agencies providing photometric data for lighting fixtures.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

F. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of fixtures for mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Fluorescent Ballast Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
2. Warranty Period for Electromagnetic Ballasts: Three years from date of Substantial Completion.

C. Special Warranty for T5 and T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: One year(s) from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Battery and Charger Data: One for each emergency lighting unit.
4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings. Contractors wishing to submit alternate equipment shall submit to the specifying authority, at least 10 days prior to bid opening, the equipment proposed to provide a precise functional equivalent system to meet specifications.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

I. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

J. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Electronic Ballasts: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Sound Rating: A.
2. Total Harmonic Distortion Rating: Less than 10 percent.
3. Transient Voltage Protection: IEEE C62.41, Category A or better.
4. Operating Frequency: 20 kHz or higher.
5. Lamp Current Crest Factor: 1.7 or less.
6. BF: 0.85 or higher.
7. Power Factor: 0.98 or higher.
8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.98 or higher.

C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

D. Single Ballasts for Multiple Lighting Fixtures: Factory-wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.98 or higher.
10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
11. Ballast Case Temperature: 75 deg C, maximum.

B. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate 1 fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Night-Light Connection: Operate one fluorescent lamp continuously.
3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Night-Light Connection: Operate one fluorescent lamp in a remote fixture continuously.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type.
5. Housing: NEMA 250, Type 1 enclosure.
6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.6 BALLASTS FOR HID LAMPS

A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
4. Open-circuit operation that will not reduce average life.
5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Sound Rating: A.
3. Total Harmonic Distortion Rating: Less than 15 percent.
4. Transient Voltage Protection: IEEE C62.41, Category A or better.
5. Lamp Current Crest Factor: 1.5 or less.
6. Power Factor: .90 or higher.
7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
8. Protection: Class P thermal cutout.
9. Retain subparagraph and associated subparagraphs below for bi-level ballasts.

2.7 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: Fluorescent, 2 for each fixture, 20,000 hours of rated lamp life.
2. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

4. Master/Remote Sign Configurations:

a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.8 FLUORESCENT LAMPS

A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

B. T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours, unless otherwise indicated.

C. T8 rapid-start low-mercury lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours, unless otherwise indicated.

D. T5 rapid-start low-mercury lamps, rated 28 W maximum, nominal length of 45.2 inches (1150 mm), 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3000 K, and average rated life of 20,000 hours, unless otherwise indicated.

E. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).

4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).

2.9 HID LAMPS

A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.

1. Dual-Arc Tube Lamps: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.

B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.

C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.

D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

2.10 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 16 Section "Electrical Supports and Seismic Restraints" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

D. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

E. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Division 16 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 16511