

PROJECT SPECIFICATION MANUAL

RANDOLPH COUNTY HEALTH UNIT

407 Camp Road - Pocahontas, AR 72455

ARCHITECT'S PROJECT NO.
190807

OCTOBER 26, 2020

ARCHITECT:

MSA

MATT SILAS ARCHITECT

212 east washington ave.
p.o. box 1702
jonesboro, arkansas 72403

tel: (870) 268-0500

fax: (870) 268-0501

email: mattsilas@sbcglobal.net

website: www.mattsilasarchitect.com

SECTION 00 0101

PROJECT TITLE PAGE

SET NUMBER _____

OCTOBER 26, 2020

PROJECT MANUAL

RANDOLPH COUNTY HEALTH UNIT

407 Camp Road
Pocahontas, AR 72455

ARCHITECT'S PROJECT NUMBER
190807

OWNER:
RANDOLPH COUNTY
107 West Broadway Street
Pocahontas, AR 72455

ARCHITECT:
MSA
MATT SILAS ARCHITECT
212 east washington ave.
p.o. box 1702
jonesboro, arkansas 72403

tel: (870) 268-0500
fax: (870) 268-0501
email: mattsilas@sbcglobal.net

SECTION 00 0107

SEALS PAGE

DISCLAIMER:

THE ARCHITECT HAS PREPARED AND IS RESPONSIBLE FOR THE ARCHITECTURAL SECTIONS (1 – 14, 31 - 33) OF THESE SPECIFICATIONS. ANY DELETION OR MODIFICATION OF THE ARCHITECT'S SPECIFICATIONS SHALL RELIEVE THE ARCHITECT OF ANY LIABILITY. IN SUCH AN EVENT, THE MODIFIER SHALL BE HELD LIABLE FOR MISSING AND MODIFIED INFORMATION. THE ARCHITECT'S CONSULTANTS ARE LIABLE AND RESPONSIBLE FOR SECTIONS PREPARED BY THE CONSULTANT.

THE ARCHITECT OF RECORD FOR:

RANDOLPH COUNTY HEALTH UNIT – POCAHONTAS, ARKANSAS

I HEREBY CERTIFY THAT THESE PLANS AND SPECIFICATIONS HAVE BEEN PREPARED BY ME, OR UNDER MY SUPERVISION. I FURTHER CERTIFY, THAT TO THE BEST OF MY KNOWLEDGE THESE PLANS AND SPECIFICATIONS ARE AS REQUIRED BY LAW AND IN COMPLIANCE WITH THE ARKANSAS FIRE PREVENTION CODE FOR THE STATE OF ARKANSAS.

MATT SILAS, AIA

MATT SILAS ARCHITECT



ARCHITECT'S SEAL

END OF SECTION

SECTION 00 0110

TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

Division 00 -- Procurement and Contracting Requirements

- 00 0101 - Project Title Page
- 00 0107 - Seals Page
- 00 0110 - Table of Contents
- 00 0115 - List of Drawing Sheets
- 00 1100 - ACEDP Bid Package For General Contractors
- 00 2113 - Instructions to Bidders
- 00 3100 - Available Project Information
- 00 4336 - Proposed Subcontractors Form
- 00 5000 - Contracting Forms and Supplements
- 00 5200 - Agreement Form
- 00 5900 - Contracting Forms and Supplements
- 00 7200 - General Conditions
- 00 7300 - Supplementary Conditions

SPECIFICATIONS

Division 01 -- General Requirements

- 01 2000 - Price and Payment Procedures
- 01 2100 - Allowances
- 01 2500 - Substitution Procedures
- 01 3000 - Administrative Requirements
- 01 3216 - Construction Progress Schedule
- 01 3300 - Weather Delays
- 01 4000 - Quality Requirements
- 01 4100 - Regulatory Requirements
- 01 4216 - Definitions
- 01 5000 - Temporary Facilities and Controls
- 01 5713 - Temporary Erosion and Sediment Control
- 01 5813 - Temporary Project Signage
- 01 6000 - Product Requirements
- 01 6160 - Volatile Organic Compound (VOC) Content Restrictions
- 01 7000 - Execution and Closeout Requirements
- 01 7800 - Closeout Submittals
- 01 8200 - Demonstration and Training

Division 02 -- Existing Conditions (NOT USED)

Division 03 -- Concrete

- 03 0516 - Underslab Vapor Barrier - Stego Industries
- 03 1000 - Concrete Forming and Accessories
- 03 2000 - Concrete Reinforcing
- 03 3000 - Cast-in-Place Concrete

03 3543 - Bonded Abrasive Polished Concrete

Division 04 -- Masonry

04 0511 - Masonry Mortaring and Grouting

04 2001 - Masonry Veneer

04 2200 - Concrete Unit Veneer Masonry

Division 05 -- Metals

05 4000 - Cold-Formed Metal Framing

05 4400 - Cold-Formed Metal Trusses

Division 06 -- Wood, Plastics, and Composites

06 1000 - Rough Carpentry

06 1600 - Zip Wall Sheathing System

06 1613 - Insulating Zip Wall Sheathing System

Division 07 -- Thermal and Moisture Protection

07 1900 - Water Repellents

07 2101 - Acoustical Insulation

07 2102 - Thermal Batt Insulation

07 2103 - Foam Board Insulation

07 3100 - Roofing Underlayment

07 4114 - Metal Roof Panels

07 4213 - Metal Soffit Panels

07 6200 - Sheet Metal Flashing and Trim

07 7123 - Manufactured Gutters and Downspouts

07 9000 - Joint Sealers

Division 08 -- Openings

08 1113 - Hollow Metal Doors and Frames

08 1416 - Flush Wood Doors

08 4313 - Aluminum-Framed Storefronts

08 5413 - Fiberglass Fixed Frame Windows

08 5619 - Interior Sliding Pass Window

08 7100 - Door Hardware

08 8000 - Glazing

Division 09 -- Finishes

09 1000 - Finish Schedule

09 2116 - Gypsum Board Assemblies

09 2215 - Metal Framing

09 2216 - Non-Structural Metal Framing

09 6520 - Resilient Wall Base

09 9000 - Painting

Division 10 -- Specialties

10 1400 - Signage

10 2601 - Wall Corner Guards

10 5213 - Fire Extinguishers, Cabinets and Accessories

10 8000 - Toilet Accessories

Division 11 -- Equipment (NOT USED)

Division 12 -- Furnishings

12 3050 - Laminate Clad Casework

Division 13 -- Special Construction (NOT USED)

Division 14 -- Conveying Equipment (NOT USED)

Division 15 - 21 (NOT USED)

Division 21 -- Fire Suppression (NOT USED)

21 0548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment

Division 22 -- Plumbing

22 0500 - Common Work Results for Plumbing

22 0513 - Common Motor Requirements for Plumbing Equipment

22 0519 - Meters and Gauges for Plumbing Piping

22 0523 - General-Duty Valves for Plumbing Piping

22 0529 - Hangers and Supports for Plumbing Piping and Equipment

22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment

22 0553 - Identification for Plumbing Piping and Equipment

22 0700 - Plumbing Insulation

22 1116 - Domestic Water Piping

22 1119 - Domestic Water Piping Specialties

22 1316 - Sanitary Waste and Vent Piping

22 1319 - Sanitary Waste Piping Specialties

22 3300 - Electric Domestic Water Heaters

22 4000 - Plumbing Fixtures

22 4700 - Water Coolers

Division 23 -- Heating, Ventilating, and Air-Conditioning (HVAC)

23 0513 - Common Motor Requirements for HVAC Equipment

23 0529 - Hangers and Supports for HVAC Piping and Equipment

23 0548 - Vibration and Seismic Controls for HVAC

23 0553 - Identification for HVAC Piping and Equipment

23 0593 - Testing, Adjusting, and Balancing for HVAC

23 0713 - Duct Insulation

23 0719 - HVAC Piping Insulation - Airex

23 2300 - Refrigerant Piping

23 3113 - Metal Ducts

23 3300 - Air Duct Accessories

23 3423 - HVAC Power Ventilators

23 3713 - Diffusers, Registers, and Grilles

23 3723 - HVAC Gravity Ventilators

23 8126 - Split-System Air-Conditioners

23 8216 - Refrigerant Air Coils

Division 25 -- Integrated Automation (NOT USED)

Division 26 -- Electrical

26 0500 - Common Work Results for Electrical

26 0519 - Low-Voltage Electrical Power Conductors and Cables

26 0526 - Grounding and Bonding for Electrical Systems

26 0529 - Hangers and Supports for Electrical Systems

26 0533 - Raceway and Boxes for Electrical Systems

26 0543 - Underground Ducts and Raceways for Electrical Systems

26 0548 - Vibration and Seismic Controls for Electrical Systems

26 0553 - Identification for Electrical Systems

26 0923 - Lighting Control Devices

26 2416 - Panelboards

26 2726 - Wiring Devices

26 2813 - Fuses

26 2816 - Enclosed Switches and Circuit Breakers

26 4313 - Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits

26 5100 - Interior Lighting

26 5600 - Exterior Lighting

Division 27 - 30 (NOT USED)

Division 31 -- Earthwork

31 1000 - Site Clearing

31 2200 - Grading

31 2316 - Excavation

31 2316.13 - Trenching

31 2323 - Fill and Backfill

31 3116 - Soil Treatment for Termite Control

Division 32 -- Exterior Improvements

32 1123 - Aggregate Base Courses

32 1216 - Asphalt Paving

32 1313 - Concrete Paving

32 1723.13 - Painted Pavement Markings

Division 33 - 49 (NOT USED)

END OF SECTION

SECTION 00 0115

LIST OF DRAWING SHEETS

COVER SHEET

CIVIL

- C-1.0 GRADING AND PAVING PLAN
- C-1.1 SITE UTILITY PLAN

ARCHITECTURAL

- A-1.1 DIMENSION FLOOR PLAN
- A-1.2 KEY FLOOR PLAN
- A-1.3 LIFE SAFETY FLOOR PLAN
- A-1.4 TOILET ROOM FLOOR PLANS, INTERIOR ELEVATIONS AND SCHEDULE.
- A-1.5 WALL TYPES AND DETAILS
- A-2.1 EXTERIOR ELEVATIONS
- A-2.2 EXTERIOR ELEVATIONS
- A-2.3 BUILDING SECTIONS
- A-3.1 WALL SECTIONS
- A-3.2 WALL SECTIONS
- A-4.1 SCHEDULES AND DETAILS
- A-4.2 DOOR DETAILS
- A-4.3 WINDOW DETAILS
- A-5.1 ROOF PLAN
- A-5.2 ROOF DETAILS
- A-6.1 REFLECTED CEILING PLAN
- A-7.1 MILLWORK AND SHELVING ELEVATIONS
- A-7.2 MILLWORK AND SHELVING SECTIONS

STRUCTURAL

- S-1.1 STRUCTURAL NOTES
- S-2.1 FOUNDATION PLAN
- S-3.1 FOUNDATION DETAILS
- S-4.1 ROOF FRAMING PLANS
- S-5.1 ROOF FRAMING DETAILS

MECHANICAL

- M-1.1 MECHANICAL FLOOR PLAN
- M-2.1 MECHANICAL SCHEDULES, NOTES AND LEGEND
- M-2.2 MECHANICAL DETAILS
- M-2.3 COMCHECK
- M-2.4 HOOD DETAILS

PLUMBING

- P-1.1 PLUMBING FLOOR PLAN - DRAIN, WASTE AND VENT
- P-1.2 PLUMBING FLOOR PLAN - DOMESTIC WATER
- P-2.1 PLUMBING SCHEDULES AND LEGEND

P-2.2 PLUMBING DETAILS
P-2.3 PLUMBING RISER DIAGRAMS

ELECTRICAL

E-0.1 ELECTRICAL LEGEND, SCHEDULES AND RISER
E-1.0 LIGHTING FLOOR PLAN
E-2.0 POWER AND AUXILIARY SYSTEMS FLOOR PLAN
E-3.0 ELECTRICAL SITE PLAN

END OF SECTION

SECTION 00 1100

ACEDP BID PACKAGE FOR GENERAL CONTRACTORS

**ARKANSAS COMMUNITY AND ECONOMIC
DEVELOPMENT PROGRAM (ACEDP)**



**Arkansas Economic Development Commission
Grants Division
900 W. Capitol Ave., Suite 400
Little Rock, Arkansas 72201
Telephone (501) 682-1211**

The Economic Development Commission does not discriminate on the basis of Race, Color, National Origin, Sex, Age, Religion or Disability; and provides upon request, reasonable accommodation including auxiliary aids and services necessary to afford an individual with a disability an equal opportunity to participate in all programs and activities.

**Bid Package for ACEDP Funded Projects
Table of Contents**

Name of Document	Page
A. Advertisement for Bids	4
B. Instruction to Bidders	5
C. Bid for Unit Price “Line-Item” Contract – NOT APPLICABLE	9
D. Bid for Lump Sum Contract	10
E. Certification of Bidder Regarding Equal Employment Opportunity	13
F. Contractor Section 3 Certification	14
G. Estimated Project Workforce Breakdown	15
H. Contract and General Provisions	16
I. Bonding and Insurance Requirements	19
J. Bid Bond	21
K. Arkansas Statutory Payment and Performance Bond	22
L. Certificate of Owner’s Attorney	23
M. General Conditions of the Contract	24
N. Supplemental Conditions of the Contract	34
O. Wage Determination Preface Sheet	35

P.	Architect’s Certification of Compliance with Minimum Standards for Access by Handicapped.	40
Q.	Regulatory Requirements	41
R.	Enumeration of Plans, Specifications and Addenda	58
S.	Technical Specifications of the Contract	60
T.	ACEDP Project Sign Specification	61
U.	Arkansas Energy Code (Form 121 and 122)	62
V.	Disclosure Required by Executive Order 98004 (Form 123)	64
W.	System for Award Management (SAM) Certification Instructions	66

**Attachment 1-A
Bid Package for ACEDP Funded Projects
Advertisement for Bids**

Date: 03-17-21
 City/County: Pocahontas / Randolph
 Project: New Randolph County Health Unit Facility
 ACEDP Grant No.: 790-08998-17

Sealed bids from licensed contractors for construction of the following project,

General Description

A new health facility located on 407 Camp Road adjacent to the Randolph County Nursing Home in Pocahontas, Arkansas.

will be received by **County Judge David Jansen** in the county judge’s office
 until **2:00 pm local time on April 06, 2021**

at **Randolph County Courthouse, 107 West Broadway, Pocahontas, AR 72455**
 and then publicly opened and read aloud.

The scope of work consists of the following:

Site work consisting of undercut excavation and replacement, building pad prep and concrete walks. The area of building footprint is approximately 4,537 square feet and the framing system is comprised of light gauge metal wall studs with light gauge roof trusses. The exterior will consist of brick veneer, cmu veneer along with metal roofing. Mechanical, plumbing and electrical work are also part of the project.

ACEDP grant requirements, Bid and Contract Forms, Plans, Specifications, and other contract documents may be obtained from the Architect. The Architect’s contact information is as follows:

Matt Silas Architect
212 East Washington Ave.,
Jonesboro, Arkansas 72401

Tel: (870) 268-0500
Email: mattsilas@sbcglobal.net

Cost per set of drawings and specifications obtained from the Architect is \$200.00 (50%-refundable for one set only if returned in unmarked, good condition) plus shipping / handling where applicable. A pdf set will be issued with a purchased printed set of documents from the Architect. No partial sets will be issued by the Architect. PDF documents may be purchased from the Architect for \$25.00. Documents may be examined and/or purchased from Jonesboro Blueprint located at 222 Madison Street, Jonesboro, AR 72401 at own cost. Documents will also be sent to Dodge Data & Analytics.

The owner reserves the right to waive any informalities or to reject any or all bids. Bidders may not withdraw their bids within 30 days after the date of bid opening and must provide bid bonds as required. All bidding processes shall be in accordance with State law.

To request bidding information or obtain further information contact: **Matt Silas Architect**
(Grantee’s Signatory Agent) **Judge David Jansen**

(Name of City or County) **Pocahontas, Arkansas, Randolph County**

Attachment 1-B
Bid Package for ACEDP Funded Projects
Instruction to Bidders

The following information is specific to prospective bidders of ACEDP-funded construction projects:

1. **Receipt and Opening of Bids**

Randolph County Judge David Jansen (herein identified as "Owner"), invites bids on the forms attached hereto, all blanks of which must be appropriately filled in. Bids will be received by the Owner at the office of the **Randolph County Judge until 2:00 pm, CST on April 01, 2021**, and then at said office publicly opened and read aloud. The envelopes containing the bids must be sealed, addressed to:

Randolph County Judge David Jansen
County Judge's Office
107 West Broadway
Pocahontas, Arkansas 72455

and designated as **Bid for Randolph County Health Unit**.

The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or scheduled time for bid opening or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within **30 days** after the actual date of bid opening.

2. **Preparation of Bid**

Each bid must be submitted on the prescribed form **and must be accompanied by completed Certification of Bidder Regarding Equal Employment Opportunity and Contractor Section 3 Certification forms**. All blank spaces for bid prices must be filled in, in ink or typewritten, in both words and figures.

Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, his address, and the name of the project for which the bid is submitted. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed as specified in the bid form. Identification of subcontractors must be per State law.

3. **Facsimile/Telegraphic Modification**

Any bidder may modify his bid by facsimile/telegraphic communication at any time prior to the scheduled closing time for receipt of bids, provided such communication is received by the Owner prior to such closing time, and, provided further, the Owner is satisfied that a written confirmation of the facsimile/telegraphic modification over the signature of the bidder was mailed prior to closing time. The communication should not reveal the bid price but should provide the addition or subtraction or other modification so that the final prices or

terms will not be known by the Owner until the sealed bid is opened. If written confirmation is not received within two days after closing time, no consideration will be given to the facsimile/telegraphic modification.

4. **Method of Bidding**

The Owner invites the following bid(s): **Lump-Sum Contract**

5. **Qualifications of Bidder**

The Owner may make such investigations as he deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein. Conditional bids shall not be accepted.

6. **Bid Security**

Each bid must be accompanied by a certified check from the bidder, or a bid bond prepared on the form of the bid bond attached hereto, duly executed by the bidder as principal and having as surety thereon a surety company, licensed in the State of Arkansas, approved by the Owner, in the amount of 5 percent of the bid. Such check or bid bond will be returned to all except the three lowest bidders within three days after the opening of bids, and the remaining checks or bid bonds will be returned promptly after the Owner and the accepted bidder have executed the contract, or, if no award has been made within 30 days after the date of the opening of bids, upon demand of the bidder at any time thereafter, so long as he has not been notified of the acceptance of his bid.

7. **Liquidated Damages for Failure to Enter into Contract**

The successful bidder, upon his failure or refusal to execute and deliver the contract and bonds required within 10 days after he has received Notice of Award shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his bid.

8. **Time of Completion and Liquidated Damages**

The bidder must agree to commence work on or before a date to be specified in a written Notice to Proceed issued by the Owner and to fully complete the project within **215 consecutive calendar days** thereafter. The bidder must agree also to pay as liquidated damages, the sum of **Five Hundred Dollars (\$500.00)** for each consecutive calendar day thereafter.

9. **Conditions of Work**

Each bidder must inform himself fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful bidder of his obligation to furnish all material and labor necessary to carry out the provisions of his contract. Insofar as possible, the contractor, in carrying out his work, must employ such methods or means as will not cause any interruption of or interference with the work of any other contractor.

10. **Addenda and Interpretations**

No interpretation of the meaning of the plans, specifications, drawings and other contract documents will be made to any bidder orally. Every request for such interpretation should be in writing addressed to

Matt Silas / Matt Silas Architect at 212 East Washington Ave., Jonesboro, Arkansas 72401

and, to be given consideration, must be received at least five days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instruction will be in the form of written addenda to the contract documents which, if issued, will be mailed by certified mail with return receipt requested to all prospective bidders (at the respective addresses furnished for such purposes), not later than three days prior to the date fixed for the opening of bids. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the contract documents.

11. **Security for Faithful Performance**

In accordance with the Notice to Proceed, the contractor shall furnish a surety bond or bonds as security for faithful performance of this contract and for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract, as specified in the General Conditions included herein. The surety on such bonds shall be a duly authorized surety company, licensed in the State of Arkansas, and satisfactory to the Owner.

12. **Power of Attorney**

Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and dated copy of their power of attorney.

13. **Notice of Special Conditions**

Attention is particularly called to those parts of the contract documents and specifications which deal with the following:

- Bonding and Insurance Requirements
- General Conditions of the Contract
- Regulatory Requirements
- Wage Rates

14. **Laws and Regulations**

The bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the contract the same as though herein written out in full.

15. **Method of Award - Lowest Qualified Bidder**

If, at the time this contract is to be awarded, the lowest base bid submitted by a responsible bidder does not exceed the amount of funds then estimated by the Owner as available to finance the contract, the contract will be awarded on the base bid only. If such bid exceeds such amount, the Owner may reject all bids or may award the contract on the base bid combined with such deductible alternates (if applicable) applied in the numerical order specified by the contract documents, as produces a net amount within the available funds.

16. **Obligation of Bidder**

At the time of the opening of bids, each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and contract documents (including all addenda). The failure or omission of any bidder to examine any form, instrument or document shall in no way relieve any bidder from any obligation in respect of his bid.

17. **Safety Standards and Accident Prevention**

With respect to all work performed under this contract, the contractor shall

- Comply with the safety standards provisions of applicable laws, building and construction codes and the Manual of Accident Prevention in Construction: published by the Associated General Contractors of America, the requirements of the Occupational Safety and Health Act of 1970 (Public Law 91-596 and the requirement of Title 29 of the Code of Federal Regulations, Section 1518, as published in the Federal Register, Volume 36, No. 75, Saturday, April 17, 1971), and specifically OSHA's Standard for Excavation and Trench Safety Systems, 29 CFR Part 1926, Subpart P.
- Exercise every precaution at all times for the prevention of accidents and the protection of persons (including employees) and property.
- Maintain at his office or other conspicuous place at the job site, all articles necessary for giving first aid to the injured, and shall make standing arrangements for the immediate removal to a hospital or a doctor's care of persons (including employees), who may be injured on the job site.

Attachment 1-C
Bid Package for ACEDP Funded Projects
Bid for Unit Price “Line-Item” Contract

NOT APPLICABLE

Attachment 1-D
Bid Package for ACEDP Funded Projects
Bid for Lump-Sum Contract

City / County Pocahontas / Randolph, Arkansas
Project Type Construction of New Health Unit Facility
Project Location 407 Camp Road - Pocahontas, Arkansas, 72455
ACEDP Project Number 790-08998-17

As bidder _____,
(Insert name of corporation, partnership or individual) in accordance with your invitation for bids for construction of the above-identified project, having examined all contract documents and the site of the proposed work, and being familiar with all of the conditions surrounding construction of the proposed project including availability of materials and labor, hereby proposes to furnish all labor, materials, and supplies and to construct the project in accordance with the contract documents, within the time set forth therein, and at the price(s) stated below. Such price(s) shall cover all expenses incurred in performing the work required by the contract documents, of which this proposal is part.

The bidder hereby agrees to commence work under this contract within 10 days after receiving a Notice to Proceed from the Owner and to fully complete the project within **215** consecutive calendar days thereafter as stipulated in the specifications. The bidder further agrees to pay as liquidated damages, the sum of **\$500** for each consecutive calendar day thereafter.

The bidder acknowledges receipt of the following addendum if applicable:

Addendum No. 1 Yes ___ No ___
Addendum No. 2 Yes ___ No ___
Addendum No. 3 Yes ___ No ___

List Additional: _____

Base Proposal

The Bidder agrees to perform all of the work contained in these contract documents for a Lump Sum Total Bid Base of _____ (\$_____).
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.)

TOTAL BID \$ _____

The above price(s) shall include all labor, materials, bailing, shoring, removal, overhead, profit, insurance, etc., to cover the finished work of the complete project.

The bid security attached in the sum of \$ _____
is to become the property of the Owner in the event the contract and bond are not executed within the
time set forth above, as liquidated damages for the delay and additional expense to the Owner caused
thereby.

Respectfully submitted:

By: _____
(Signature)

By: _____
(Signature)

Company DUNS Number

(Please Print Name of Owner/Contractor)

Individual/Company Tax ID Number

(Seal - if bid is by a corporation)

(Title)

(Business Address and Zip Code)

(Date)

Attachment 1-E
Bid Package for ACEDP Funded Projects
Certification of Bidder Regarding Equal Employment Opportunity

This certification is required pursuant to Executive Order 11246 (30 FR 12319-25) which provides that any bidder or prospective contractor or any of their proposed subcontractors, shall state as an initial part of the bid whether it has participated in any previous contract or subcontract subject to the equal opportunity clause; and if so, whether it has filed all compliance reports due under applicable instructions. Where the certification indicates that the bidder has not filed a compliance report due under applicable instructions, such bidder shall be required to submit a compliance report within seven (7) calendar days after bid opening. **No contract shall be awarded unless such report is submitted.**

Certification by Bidder
Name and Address of Bidder (Including Zip Code)

<i>Name and Title of Bidder's Agent</i>

1. Has the bidder participated in a previous contract or subcontract subject to the Equal Opportunity Clause?
Yes No

2. Were compliance reports required to be filed in connection with such contract or subcontract?
Yes No

3. Has the bidder filed all compliance reports due under applicable instructions?
Yes No N/A

4. Has the bidder ever been or is being considered for sanction due to violation of Executive Order 11246, as amended?
Yes No

_____	_____
<i>Signature and Title of Bidder's Agent</i>	<i>Date</i>

Attachment 1-F
Bid Package for ACEDP Funded Projects
Contractor Section 3 Certification

_____ (*Name of contractor*) agrees to implement the following specific affirmative steps directed at increasing the utilization of lower income residents and businesses within the City or County of _____.

- | | |
|----|---|
| A. | To implement Section 3 requirements by seeking the assistance of local officials in determining the exact boundaries of the applicable project area |
| B. | To attempt to recruit from within the City/County the necessary number of lower income residents through: local advertising media, signs placed at the proposed site for the project, and community organizations and public or private institutions operating within or serving the project area |
| C. | To maintain a list of all lower income residents who have applied either on their own or on referral from any source, and to employ such persons, if otherwise eligible and if a vacancy exists |
| D. | To insert this Section 3 plan in all bid documents, and to require all bidders to submit a Section 3 affirmative action plan (when contracts exceed \$10,000) including utilization goals and the specific steps planned to accomplish these goals |
| E. | To formally contact unions, subcontractors, and trade associations to secure their cooperation for this project |
| F. | To ensure that all appropriate project area business concerns are notified of pending subcontractual opportunities |
| G. | To maintain records, including copies of correspondence, memoranda, etc., which document that all of the above affirmative action steps have been taken |
| H. | To appoint or recruit an executive official of the company or agency as Equal Opportunity Officer to coordinate the implementation of this Section 3 plan |
| I. | To list on the Estimated Project Workforce Breakdown form, all projected workforce needs for this project by job classification |

As officers and representatives of _____
(*Name of contractor*)

We, the undersigned, have read and fully agree to the above and become a party to the full implementation of this program.

Title

Date

Signature

**Attachment 1-G
Bid Package for ACEDP Funded Projects
Estimated Project Workforce Breakdown**

Job Category	Total Estimated Positions	No. of Positions Currently Occupied by Permanent Employees	No. of Vacant Positions	No. of Positions to be Filled With LIPAR (Note 1)*
Officers/Supervisors				
Professionals				
Technicians				
Office				
Clerical				
Trade				
Journeyman				
Apprentices				
Trainees				
Others				
Total				

* Note 1: Lower Income Project Area Residents. Individuals residing within the City/County of _____ whose family income does not exceed 80 percent of the median income in the area.

_____ *Company*

Attachment 1-H
Bid Package for ACEDP Funded Projects
Contract and General Provisions

THIS AGREEMENT, made and entered into this _____ day of _____ 20____, by and between _____, hereinafter called the "Contractor" and _____, hereinafter called the "Owner".

In consideration of the mutual premises and agreements contained herein, the undersigned Contractor and Owner agree as follows:

A. The Contractor shall

1. Furnish all labor, materials, tools, machinery, supervision and services necessary to perform all of the work in accordance with the description of work consisting of all plans, specifications, and supplemental contract documentation, dated **10-26-20** for work defined in **Pocahontas, Arkansas**, for the sum of \$_____.
2. Perform all work timely and diligently in a good and workmanlike manner using approved or equal materials as specified by the Grantee.
3. Begin work within 10 calendar days of receipt of the written Notice to Proceed and shall complete the work within _____ calendar days thereafter.
4. Carry Worker's Compensation and Employer's Liability Insurance in accordance with the laws of the State of Arkansas for all persons engaged in work at the site; and carry Contractor's Public Liability and Property Damage Insurance and Comprehensive Automobile Liability Insurance.
5. Furnish, before beginning the work, a Certificate of Insurance showing compliance with the provisions of Section A, Paragraph 4 above.
6. Keep the premises clean and orderly during the work and upon substantial completion of the contract, remove all rubbish, tools, scaffolding, and surplus materials from and about the site(s) and leave the work and premises consistent with prior appearance or equivalent. Material and equipment that have been removed and replaced as part of the work shall belong to the contractor.

Not assign the contract without written consent from the Owner.

8. Guarantee the work performed for a period of twelve months from the date of final acceptance of all work required by this contract. Furthermore, furnish the Owner and the Grantee with all manufacturer's and supplier's written guarantees and warranties covering materials and equipment furnished under this contract.
9. Furnish the Owner, upon completion of the work and upon final payment by the Owner, a Release of Lien Form certifying that all charges for materials, labor, and/or any other expenses incurred by the Contractor pertaining to the execution of this contract have been paid in full.

10. Defend, indemnify and hold harmless the Owner, the Arkansas Economic Development Commission, their agents or employees from and against any and all claims for injuries or damages to persons or property of any kind or character, whatsoever, whether real or asserted, arising out of the performance of this contract. Furthermore, shall assume all liability and responsibility for injuries, claims or suits for damages, to persons or property of any kind or character, whatsoever, whether real or asserted, arising out of the performance of this contract.

B. The Owner Shall

1. Not make, or permit to be made, any changes to the description of work, without written approval from the Economic Development Commission.
2. Permit the contractor to use existing utilities such as lights, heat, power and water necessary to carry out and complete the work as specified.
3. Cooperate with the contractor to facilitate the performance of the work.
4. Issue a written Notice to Proceed to the contractor within ten (10) days from the date of this agreement.

C. Method of Compensation:

1. Payment for work shall be on percentage complete, plus on-site stored materials minus retainage. Final payment shall be made after: a Certificate of Substantial Completion has been executed; Economic Development Commission has received the contractor's Final Invoice and a satisfactory release of liens, or claims for liens, by subcontractors, laborers and material supplies for completed work or installed materials; and, after a final inspection has been conducted.
2. The contractor shall be liable for and shall pay to the Owner the sum of **\$500.00** as fixed, agreed and liquidated damages for each calendar day of delay from the above stipulated completion date (Section A, Paragraph 3) or as modified by a properly executed Change Order until such work is satisfactorily completed and accepted by the Owner and Grantee.

D. General Provisions:

1. The contractor agrees to perform all contract work as specified, and the Owner agrees that neither he nor the members of his family, his tenants, agents, or employees will hinder the contractor or his work.
2. The contractor shall take affirmative steps to ensure that applicants for employment are not discriminated against in any manner prescribed by the Regulatory Requirements of this contract during employment. Employment activities shall include, but not be limited to employment, upgrading, demotion, or transfer; termination, rates of pay or other forms of compensation; and selection for training, including apprenticeship.
3. The contractor shall post in conspicuous places, for employees and applicants for employment, notices setting forth the provisions, as stated, of the non-discrimination clause contained within the contract's Regulatory Requirements.

- 4. The contractor shall incorporate the foregoing requirements in all subcontracts.
- 5. In the event of any breach of this contract by the contractor, the Owner and the Grantee may, at their option, engage the services of another contractor to complete the work and deduct the cost of such completion from any amount due the contractor.
- 6. This contract embodies all of the representations, rights, duties, and obligations of the parties hereto, and any prior oral or written agreement not embodied herein shall not be binding upon or endure to the benefit of any of the parties.

This Contract and All Terms and Conditions Contained Herein Are Approved and Accepted as of the Date First Above Written.

Signature: _____
 Title: _____
(Owner)

Attest By:
 Signature: _____
 Title: _____
(Secretary)

Attest By:
 Signature: _____
 Title: _____
(Witness)

Signature: _____
 Title: _____
(Contractor)

Attest By:
 Signature: _____
 Title: _____
(Secretary)

Attest By:
 Signature: _____
 Title: _____
(Witness)

Attachment 1-I
Bid Package for ACEDP Funded Projects
Bonding and Insurance Requirements

- 1.1 This section defines **ACEDP grant requirements for bonding and insurance**. No other bonding and insurance requirements, unless specified by State law, shall be imposed.
- 2.1 Entities receiving Federal assistance which involves contracting for construction or facility improvements shall follow State law relating to bid guarantees, performance bonds, and payment bonds except for contracts exceeding \$100,000. **For contracts exceeding \$100,000, the following minimum bonding requirements shall apply:**
 - 2.1.1 A bid guarantee from each bidder equivalent to 5 percent of the bid price. The "**bid guarantee**" shall consist of a firm commitment such as a bid bond, certified check, or other negotiable instrument accompanying a bid as assurance that the bidder will, upon acceptance of his bid, execute such contractual documents as may be required within the time specified.
 - 2.1.2 A "**performance bond**" furnished by the contractor in an amount at least equal to 100 percent of the contract price as security for faithful performance of the contract.
 - 2.1.3 A "**payment bond**" in an amount not less than 100 percent of the contract price or in a penal sum not less than that prescribed by State law, to assure contractor payment of all persons performing labor on the project under this contract and/or furnishing materials and supplies during the execution of this contract.

The performance bond and the payment bond may be in one or in separate instruments in accordance with State law.

- 3.1 Where bonds are required as per section 2.1 above, the bonds shall be obtained from **acceptable companies** holding certificates of authority within the State of Arkansas.
- 4.1 **Additional or Substitute Bond** If, at any time, the Owner, for justifiable cause, shall be dissatisfied with any surety or sureties, then upon the Performance or Payment Bonds, the contractor shall within five (5) days after notice of dissatisfaction, substitute an acceptable bond (or bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on such bond(s) shall be paid by the contractor. No further payments shall be deemed due nor made until the new surety or sureties furnish acceptable bond(s) to the Owner.

5.1 **Insurance**

The contractor shall not commence work under this contract until he has obtained all insurance, as approved by the Owner, required under this paragraph, nor shall the contractor allow any subcontractor to commence work on his subcontract until the subcontractor's required insurance has been obtained and approved.

- 5.1.1 **Compensation Insurance:** The contractor shall procure and maintain throughout this contract Workmen's Compensation Insurance as required by applicable State law for all of his employees engaged in work at the site of the project under this contract and, in case of any such work sublet, the contractor shall require the subcontractor similarly to provide Workmen's Compensation Insurance for all of the latter's employees

engaged in such work unless such employees are covered by the protection afforded by the contractor's Workman's Compensation Insurance. In case any class of employees engaged in hazardous work under this contract is not protected under the Workmen's Compensation Statute, the contractor shall provide and shall cause each subcontractor to provide adequate employer's liability insurance for the protection of his employees as are not otherwise protected.

- 5.1.2 **Contractor's Public Liability and Property Damage and Vehicle Liability Insurance:** The contractor shall procure and shall maintain during the life of this contract Contractor's Public Liability Insurance, Contractor's Property Damage Insurance and Vehicle Liability Insurance in amounts specified in the contract conditions.
- 5.1.3 **Subcontractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance:** The contractor shall either (1) require each of his subcontractors to procure and to maintain during the life of his subcontract, Subcontractor's Public Liability and Property Damage Insurance and Vehicle Liability Insurance of the type and in the amounts specified in the Supplementary Contract Conditions or, (2) obtain policy insurance on such activities as specified in subparagraph 5.1.2 above.
- 5.1.4 **Scope of Insurance and Special Hazards:** The insurance required under subparagraphs 5.1.2 and 5.1.3 above shall provide adequate protection for the Contractor and his subcontractors, respectively, against damage claims which may arise from operations under this contract, whether such operations be by the insured or by anyone directly or indirectly employed by him and, also against any of the special hazards, if specified, which may be encountered in the performance of this contract.
- 5.1.5 **Risk Insurance:** The Owner or contractor may be required to maintain Risk Insurance on a 100 percent completed value based on the insurable portion of the project (until accepted by the Owner as substantially complete) for the benefit of the Owner, the Contractor, or subcontractors as their interests may appear. Any requirements pertaining to adequacy of Risk Insurance shall be as per State law.
- 5.1.6 **Proof of Carriage of Insurance:** The contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates and date of expiration of policies. Such certificates shall also contain substantially the following statement: "The insurance covered by this certificate will not be canceled or materially altered, except after ten (10) days written notice has been received by the Owner."

Attachment 1-J
Bid Package for ACEDP Funded Projects
Bid Bond

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____
_____ as Principal, and
_____ as Surety, are hereby held and firmly
bound unto _____, as Owner, in the penal sum of
_____ for the payment of which, well and truly to
be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators,
successors and assigns. Signed, this _____ day of _____, 20__.

The condition of the above obligation is such that whereas the Principal has submitted to
_____ a certain Bid, attached hereto and hereby made a part
hereof to enter into a contract in writing, for the _____

NOW, THEREFORE.

- A. If said Bid shall be rejected, or in the alternate,
- B. If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract specified (properly completed in accordance with said Bid) and shall furnish a bond for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said Bid, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such Bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

Surety

Surety Agent

Principal

Seal

Note: Surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570, as amended) as authorized to transact business in Arkansas and have underwriting authority in an amount equal to or greater than the bid amount.

Attachment 1-K
Bid Package for ACEDP Funded Projects
Arkansas Statutory Payment and Performance Bond

We _____, as
Principal, hereinafter called Principal, and _____
authorized to do business in the State of Arkansas, as Surety, hereinafter called Surety, are held and
firmly bound unto _____ as Obligee, hereinafter
called Owner, in the amount of _____
Dollars (\$ _____), for the payment whereof Principal and Surety bind themselves,
their heirs, personal representatives, successors and assigns, jointly and severally, by these presents.

Principal has by written agreement dated _____ entered into a contract with Owner for

_____ which contract is by reference made a part hereof and hereinafter referred to as the Contract.

THE CONDITION OF THIS OBLIGATION is such that if the Principal shall faithfully perform the Contract on his part and shall fully indemnify and save harmless the Owner from all cost and damage which he may suffer by reason of failure to do so and shall fully reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any such default, and further, that if the Principal shall pay all persons all indebtedness for labor or materials furnished or performed under said Contract, failing which such persons shall have a direct right of action against the Principal and Surety, jointly and severally, under this obligation, subject to the Owner's priority, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

No suit, action or proceeding shall be brought on this bond outside the State of Arkansas. No suit, action or proceeding shall be brought on this bond except by the Owner after six months from the date final payment is made on the Contract, nor shall any suit, action or proceeding be brought by the Owner after two years from the date on which the final payment under the Contract falls due.

Any alterations which may be made in the terms of the Contract, or in the work to be done under it, or the giving by the Owner of any extension of time for the performance of the Contract, or any other forbearance on the part of either the Owner or the Principal to the other shall not in any way release the Principal and the Surety or Sureties, or either or any of them, their heirs, personal representatives, successors or assigns from their liability hereunder, notice to the Surety or Sureties of any such alteration, extension or forbearance being hereby waived.

In no event shall the aggregate liability of the Surety exceed the sum set out herein.

Executed on this _____ day of _____, 20____

Principal

Surety Agent

Attorney-in-Fact

Attachment 1-L
Bid Package for ACEDP Funded Projects
Certificate of Owner's Attorney

I, the undersigned, _____, the duly authorized and acting legal representative of _____, do hereby certify as follows:

I have examined the attached contract(s) and surety bonds and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions and provisions thereof.

Attorney Signature

Date

Attachment 1-M
Bid Package for ACEDP Funded Projects
General Conditions of the Contract

1.1 Definitions

1.1.1 Contract and Contract Documents

The project to be constructed pursuant to this contract will be financed with assistance from Community Development Block Grant funds and is subject to all applicable Department of Housing and Urban Development (HUD), State and Federal laws.

The plans, specifications, contract documents and any addenda shall form part of this Contract and the provisions thereof shall be as binding upon the parties hereto as if they were incorporated verbatim. The table of contents, titles, headings, running headlines and marginal notes contained herein and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or infer interpretation of the provisions to which they refer.

1.2 Execution

1.2.1 Six copies of the Contract Documents shall be signed by the Owner and contractor.

1.2.2 Words and abbreviations which have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.

1.3 Contract Authorization

1.3.1. All original Drawings and Specifications will remain in the ownership of the architect or engineer. Notice and description of any changes to the original documents or scope of work by the contractor shall be communicated to the architect/engineer prior to completion of the affected work.

1.3.2 The Owner, architect/engineer and funding agencies shall have access to the construction site at all times and shall make site visits as necessary to verify project progress.

1.3.3 The architect/engineer shall make, or have made, determinations that the work for each payment request is or is not complete and meets the requirements of the contract documents. The request for payment process shall be defined at the Preconstruction Conference.

1.3.4 The architect/engineer shall have the authority to request corrections to deficient work by notifying the contractor in writing.

1.3.5 The contractor shall meet the requirements of all State, Federal and local laws including, but not limited to those listed in these contract documents as **Regulatory Requirements**.

1.3.6 The architect/engineer shall give all orders and directions under this contract, relative to execution of work including the amount, quality, acceptability, and fitness of the work and materials which are to be paid for under this contract and shall decide all

questions which may arise in relation to work and the construction thereof. The architect or engineer's decisions shall be final and conclusive, except as State law may otherwise prescribe. Any differences or conflicts in regard to the contract documents that may arise between the contractor performing work for the architect/engineer shall be adjusted and determined by the architect/owner after consultation with the contractor.

- 1.3.7 All work and materials, whether incorporated in the work or not, all processes of manufacture, and all methods of construction shall be at all times and places subject to the inspection of the Owner, engineer or architect or representative(s) thereof, who shall adjudge the quality and suitability of the work, materials, processes of manufacture, and methods of construction for the purposes for which they are used. Should they fail to meet their approval they shall be forthwith reconstructed, made good, replaced and/or corrected, as the case may be, by the contractor at his own expense. Rejected material shall immediately be removed from the site. If, in the opinion of the architect/engineer, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the contract documents, the compensation to be paid to the contractor shall be reduced by such amount adjudged by the architect/engineer as equitable.
- 1.3.8 No claim for extra work or cost shall be allowed unless authorized by change order executed by the engineer/architect and approved by the Owner and the Economic Development Commission. In the event of temporary suspension of work, or during inclement weather, or whenever the engineer or architect shall direct, the contractor will, cause his subcontractors to protect carefully his and their work and materials against damage or injury from the weather. If, in the opinion of the architect/engineer, any work or materials were damaged or injured by reason of failure on the part of the contractor or any of his subcontractors, such materials shall be removed and replaced at contractor expense.
- 1.3.9 Should the contractor encounter site conditions that differ from the contract documents, he shall immediately give notice to the architect/engineer before commencing work on the affected properties. The architect/engineer will thereupon investigate, or have investigated the conditions, and if found that they materially differ from those shown in the contract documents, will request changes as deemed necessary. Any increase or decrease of cost resulting from such changes shall be adjusted as per the General Conditions.

2.1 Definitions

- 2.1.1 The following terms as used in this contract are respectively defined as follows:
- 2.1.2 **Contractor:** A person, firm or corporation with whom the owner contracts with.
- 2.1.3 **Subcontractor:** A person, firm or corporation supplying labor and materials or only labor for work at the site of the project for, and under separate contract or agreement with the contractor.

- 2.1.4 **Work on (at) the project:** Work to be performed at the location of the project, including the transportation of materials and supplies to or from the location of the project by employees of the contractor and any subcontractor.

3.1 Contractor's Responsibilities

- 3.1.1 The contractor shall and will, in good workmanlike manner, complete and perform all work and furnish all supplies, materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, necessary to perform and complete all the work required by this contract. He shall furnish, erect, maintain, and remove such construction plant and such temporary works as may be required.

The contractor shall observe, comply with, and be subject to all terms, conditions, requirements, and limitations of the contract documents, and complete the entire work to the satisfaction of the engineer/architect and Owner.

It is understood that unless otherwise specifically stated in the contract documents, the contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every kind, and all other services and facilities of every kind whatsoever necessary to execute, complete, and deliver the complete project within the specified time. Any work necessary to be performed after regular working hours, on Sundays or legal Holidays, shall be performed without additional Owner expense.

- 3.1.2 The contractor shall at all times safe guard the Owner's property from injury or loss in connection with this contract. He shall at all times safe guard and protect his own work, and that of adjacent property from damage. In case of emergency, which threatens loss or injury of property, and/or safety or life, the contractor will be allowed to act, without previous instructions from the architect/engineer, in a diligent manner. He shall notify the engineer/architect of actions immediately thereafter. Any claim for compensation by the contractor due to such extra work may be submitted to the architect/engineer for approval and Owner for consideration. Where the contractor has not taken action but has notified the architect/engineer of an emergency threatening injury to persons or damage to the work or any adjoining property, he shall act as instructed or authorized by the architect/engineer.

The amount of reimbursement to the contractor on account of any emergency action shall be determined in the manner provided in the general conditions.

3.2 Contractor Requirements

The contractor shall

- 3.2.1 Take every precaution against injuries to persons or damage to property;
- 3.2.2 Store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the work or elsewhere as will not unduly interfere with the progress of his work or the work of any other contractors;

- 3.2.3 Clean up frequently all refuse, rubbish, scrap materials, and debris caused by his operations, to the end that at all times the site of the work shall present a neat, orderly and workmanlike appearance;
- 3.2.4 Before final payment, remove all surplus material, temporary structures, equipment and debris of every nature resulting from his operations, and to put the site in an orderly condition;
- 3.2.5 Effect all cutting, fitting or patching of his work to conform to the contract documents.
- 3.2.6 No materials or supplies for the work shall be purchased by the contractor or by any subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which interest is retained by the seller. The contractor warrants that he has good title to all materials and supplies used by him in the work, free from all liens, claims or encumbrances.
- 3.2.7 The contractor shall not assign the whole or any part of this contract or any moneys due or to become due hereunder without written consent of the Owner. In case the contractor assigns all or any part of any moneys due or to become due under this contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the contractor shall be subject to prior claims of all persons, firms and corporations of services rendered or materials supplied for the performance of the work called for in this contract.
- 3.2.8 If, through contractor neglect, any other contractor or subcontractor suffers loss or damage on the work, the contractor agrees to settle with such other parties by agreement or arbitration if such parties will so settle. If such other contractors or subcontractors shall assert any claim against the Owner on account of any damage alleged to have been sustained, the Owner shall notify the contractor, who shall indemnify and save harmless the Owner against any such claim.
- 3.2.9 Neither the final certificate of payment nor any provision in the contract documents, shall constitute an acceptance of work not completed in accordance with the contract documents or relieve the contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from the date of final acceptance of the work unless a longer period is specified. The Owner will give notice of observed defects with reasonable promptness.

3.3 Subcontractor's Responsibilities

- 3.3.1 The contractor may hire specialty subcontractors to complete work which, under normal contracting practices, is performed by specialty subcontractors, however, the contractor shall be fully responsible to the Owner for the acts or omissions of his subcontractors, and of persons either directly or indirectly employed by him.
- 3.3.2 The contractor shall coordinate his operations with those of other contractors in the arrangement for storage of materials and in the detailed execution of the work. The

contractor, including his subcontractors, shall keep informed of the progress and the detail work of other contractors and shall notify the Owner immediately of lack of progress or defective workmanship on the part of other contractors. Failure of a contractor to keep informed of the work progressing on the site and failure to give notice of lack of progress or defective workmanship by others shall be construed as acceptance by him of the status of the work as being satisfactory.

3.4 Patents

The contractor shall hold and save the Owner and its officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the contract, including its use by the Owner, unless otherwise specifically stipulated in the Contract Documents. License and/or Royalty Fees for the use of a process which is authorized by the Owner must be reasonable, and paid to the holder of the patent, or his authorized licensee, direct by the Owner and not by or through the contractor.

If the contractor uses any design, device or materials covered by letters, patent or copyright, he shall provide for such use by suitable agreement with the holder of such patented or copyrighted design, device or materials. It is mutually understood that, without exception, the contract price shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The contractor and/or his Sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract, and shall indemnify the Owner for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

3.5 Superintendence

At the site of the work, the contractor shall employ a construction superintendent or foreman who shall have full authority to act for the contractor.

3.6 Conflicting Conditions

Any provisions in any of the contract documents, which may be in conflict, or inconsistent with any of the paragraphs in these General Conditions shall be void to the extent of such conflict or inconsistency.

3.7 Arkansas Economic Development Commission Inspection

Authorized representatives of the Arkansas Economic Development Commission shall be permitted to inspect all work, materials, personnel records, invoices of materials, and other data and records of the contractor and his subcontractor(s).

3.8 Payment Provisions

3.8.1 To ensure the proper performance of this contract, the Owner shall retain ten percent (10%) of the amount of each estimate until the project is 50 percent complete. Final

retainage shall be released upon acceptance of the Certificate of Substantial Completion.

- 3.8.2 In preparing payment estimates, materials stored on the site and preparatory work completed may be included.
- 3.8.3 The contractor agrees to indemnify and hold the Owner harmless from all claims arising from the lawful demands of subcontractors, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies incurred in the performance of this contract. The contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the above nature have been paid, discharged, or waived. If the contractor fails to do so, then the Owner may, after having served written notice to the contractor, pay unpaid bills (of which the owner has written notice), and direct, or withhold from the contractor's unpaid compensation, a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the contractor shall be resumed, in accordance with the terms of this contract. In no event shall the above sentences impose any obligations upon the Owner to the contractor or his surety. In paying any unpaid bills of the contractor, the Owner shall be deemed the contractor's agent, and any such payments made by the Owner shall be considered as payment made under the contract to the contractor and the Owner will not be liable to the contractor for any such payments.
- 3.8.4 After execution and delivery of the contract prior to making the first partial payment, the contractor shall deliver to the owner an estimated construction progress schedule in a form satisfactory to the owner, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the contract documents and the anticipated amount of each monthly payment that will become due in accordance with the progress schedule. The contractor shall furnish on forms supplied by the Owner a detailed estimate giving a complete breakdown of the contract price and periodic itemized estimates of work completed for the purpose of making partial payments thereon. The costs employed in maintaining these schedules will be used only to determine the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the contract price.
- 3.8.5 The contractor shall procure and pay all permits, licenses and approvals necessary for the execution of his contract.

4.1 **Changes in Work**

No changes in the work defined within the contract documents shall be made without a change order. Charges or credits for the work covered by the change order shall be determined by one or more, or a combination of the following:

- Unit bid prices previously approved
- An agreed upon lump sum
- The actual cost of labor, including foremen
- Materials entering permanently into the work
- The ownership or rental cost of construction plant and equipment during the time of use on the extra work

- Power and consumable supplies for the operation of power equipment
- Insurance, Social Security and unemployment contributions

4.2 Additional Instructions and Drawings

If necessary, the contractor will be furnished additional instructions and drawings to execute contract work. These additional drawings and instructions will be prepared so that they can be generally interpreted as part of the contract documents thereof. Any additional instructions or drawings will be issued to and discussed by all parties and shall be carried out by the contractor as specified.

4.3 Contractor and Owner

4.3.1 It is hereby understood and mutually agreed, by and between the contractor and the Owner, that the date of beginning and the time for completion, as specified in the contract, of the work to be completed hereunder, are Essential Conditions of this contract; and it is further mutually understood and agreed that the work to be completed in this contract shall be started on a date to be specified in the "Notice to Proceed."

If the contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension of time granted by the Owner, then the contractor does hereby agree, as a part consideration for the awarding of this contract, to pay to the Owner the amount specified in the contract, not as a penalty, but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the contractor shall be in default after the time stipulated in the contract for completing the work.

Provided, that the contractor shall not be charged with liquidated damages or any excess cost where the Owner determines that the contractor is without fault and the contractor's reasons for the time extension are acceptable to the Owner;

Provided further, that the contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due to;

- a. Any preference, priority or allocation order duly issued by the Government;
- b. Unforeseeable cause beyond the control and without the fault or negligence of the contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and documented severe weather; and,
- c. Any delays of subcontractors or suppliers occasioned by any of the causes specified in subsections (a) and (b) of this article;

Provided further, that the contractor shall, within ten (10) days from the beginning of such delay, unless the Owner shall grant a further period of time prior to the date of final settlement of the contract, notify the Owner, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the contractor within a reasonable time of its decision in the matter.

4.3.2 Should the Owner be prevented or enjoined from proceeding with work either before or after the start of construction by reason of any litigation or other reason beyond the

control of the Owner, the contractor shall not be entitled to make or assert claim for damage by reason of said delay; but time for completion of the work will be extended to such reasonable determination to be set forth in writing.

- 4.3.3 Any notice to any contractor from the Owner relative to any part of this contract shall be in writing and considered delivered and the service thereof completed, when said notice is posted, by certified or registered mail, to the said contractor at his last given address, or delivered in person to the said contractor or his authorized representative on the work.

5.1 Owner

- 5.1.1 The Owner is the entity identified in the Owner-Contractor Agreement and is referred to as such in the contract documents. The term Owner means the Owner or his authorized representative.
- 5.1.2 Prior to the start of construction, the Owner shall obtain all land and rights-of-way necessary for carrying out and completion of work to be performed under this contract. The contractor shall comply with all laws, ordinances, rules, orders, and regulations relating to performance of the work, the protection of adjacent property, and the maintenance of passageways, guard fences or other protective facilities.
- 5.1.3 Unless otherwise expressly provided for in the contract documents, the Owner will furnish to the contractor all surveys necessary for the execution of the work.
- 5.1.4 No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting, or approving any contracts or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part hereof. No officer, employee, attorney, or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other pertinent contract.
- 5.1.5 Should any provisions of this contract be violated by the contractor, or any of his subcontractors, the Owner may serve written notice upon the contractor and the Surety of its intention to terminate the contract. Such notices shall contain the reasons for such intention to terminate the contract, and unless within ten (10) days after the serving of such notice upon the contractor, such violation, or delay shall cease and satisfactory arrangement of correction be made, the contract shall, upon the expiration of said ten (10) days, cease and terminate. In the event of any such termination, the Owner shall immediately serve notice thereof upon the Surety and the contractor and the Surety shall have the right to take over and perform the contract; provided, however, that if the Surety does not commence performance thereof within ten (10) days from the date of the mailing to such Surety of notice of termination, the Owner may take over the work and prosecute the same to completion by contract or by force account at the expense of the contractor and the contractor and his Surety shall be liable to the Owner for any excess cost occasioned the Owner thereby, and in such event the Owner may take possession of and utilize in completing the work, such

materials, appliances, and plant as may be on the site of the work and necessary therefore.

- 5.1.5 The Owner shall meet the requirements of all State, Federal and local laws including but not limited to those listed in these contract documents as Regulatory Requirements.

6.1 Safety Standards and Accident Prevention

With respect to all work performed under this contract, the contractor shall:

- 6.1.1 Comply with the safety standards provisions of applicable laws, building and construction codes and the Manual of Accident Prevention in Construction: published by the Associated General Contractors of America, the requirements of the Occupational Safety and Health Act (OSHA) of 1970 (Public Law 91-596) and the requirements of Title 29 of the Code of Federal Regulations, Section 1518, as published in the Federal Register, Volume 36, Number 75, Saturday, April 17, 1971, and specifically, OSHA's Standard for Excavation and Trenches Safety Systems, 29 CFR Part 1926, Subpart P.
- 6.1.2 Exercise every precaution at all times for the prevention of accidents and the protection of persons (including employees) and property.
- 6.1.3 Maintain, at his office or other conspicuous place at the job site, all articles necessary for giving first aid to the injured, and shall make standing arrangements for the immediate removal to a hospital or a doctor's care of persons (including employees), who may be injured on the job site.

7.1 Miscellaneous Provisions

- 7.1.1 The architect/engineer shall review all submittals to include but not be limited to samples, shop drawings and product data. The architect/engineer shall provide the contractor with approved or rejected submittals within ten business days of their receipt. The contractor shall retain one copy in his construction files at all times and provide one copy to the resident project representative. Upon completion of the contract, the contractor shall provide the complete submittal file to the owner who will retain them in the permanent construction file. Upon receiving a rejected submittal, the contractor shall resubmit an alternate or provide what was originally specified.
- 7.1.2 The contractor shall insert in any subcontracts the Federal Labor Standards Provisions Contained herein (See Regulatory Requirements) and such other clauses as the Economic Development Commission may deem necessary, and also, a clause requiring subcontractors to include these clauses in any lower tier subcontracts which they may enter into, together with a clause requiring this insertion in any further subcontracts that may in turn be made.
- 7.1.3 The contractor may agree to the use and occupancy of a portion or unit of the project before formal acceptance by the owner provided that the owner secures written consent of the contractor, except in the event, in the opinion of the architect/engineer, the contractor is chargeable with unwarranted delay in final cleanup of punch list items or other contract requirements. Also, an endorsement of the insurance-carrier and

consent of the surety permitting occupancy of the building or use of the project during the remaining period of construction must be secured.

- 7.1.4 All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the owner (in accordance with State procurement requirements) who will pay for all such services direct and exclusive to this contract. Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

Attachment 1-N
Bid Package for ACEDP Funded Projects
Supplemental Conditions of the Contract

8.1 Special Hazards

The contractor's and his subcontractor's Public Liability and Property Damage Insurance shall provide adequate protection against the following special hazards:

8.1.1 Contractor’s and Subcontractor’s Public Liability, Vehicle Liability and Property Damage Insurance. As required in the General Conditions, the Contractor's Public Liability Insurance and Vehicle Liability Insurance shall be in an amount not less than _____ for injuries, including accidental death, to any one person, and subject to the same limit for each person, in an amount not less than \$ _____ on account of one accident, and

Contractor's Property Damage Insurance in an amount not less than \$_____.

8.1.2 The Contractor shall either require each of his subcontractors to procure and to maintain during the life of his subcontract, Subcontractor's Public Liability and Property Damage of the type and in the same amounts as specified in the preceding paragraph, or insure the activities of his subcontractors in his own policy.

8.1.3 The contract documents shall consist of all specifications, plans, contract documents and addenda for the project.

9.1 Supplementary Contract Conditions

Any supplementary conditions of the contract must be inserted below:

**Attachment 1-O
Bid Package for ACEDP Funded Projects
Wage Determination Preface Sheet**

"General Decision Number: AR20210012 01/01/2021

Superseded General Decision Number: AR20200012

State: Arkansas

Construction Type: Building

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

County: Randolph County in Arkansas.

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.95 for calendar year 2021 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.95 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2021. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/01/2021

ENGI0624-006 01 / 01 / 2017

Rates	Fringes
-------	---------

POWER EQUIPMENT OPERATOR

Crane.....	\$ 26.20	12.30
Forklift.....	\$ 26.20	12.30

* IRON0321-010 08 / 01 / 2019

Rates	Fringes
-------	---------

IRONWORKER, STRUCTURAL.....	\$ 22.00	19.26
-----------------------------	----------	-------

PAIN0424-008 07 / 01 / 2019

	Rates	Fringes
PAINTER (Spray).....	\$ 16.10	6.97

SHEE0036-035 06 / 01 / 2015

	Rates	Fringes
SHEET METAL WORKER (HVAC Duct Installation Only).....	\$ 22.64	13.35

SUAR2015-009 01 / 09 / 2017

	Rates	Fringes
BRICKLAYER.....	\$ 19.15	0.00
CARPENTER, Includes Drywall Hanging.....	\$ 20.72	0.00
CEMENT MASON/CONCRETE FINISHER.....	\$ 21.08	0.00
ELECTRICIAN.....	\$ 21.76	11.45
LABORER: Common or General.....	\$ 11.12	0.00
LABORER: Mason Tender - Brick.....	\$ 12.32	0.00
OPERATOR: Backhoe/Excavator/Trackhoe.....	\$ 23.08	0.00
OPERATOR: Bulldozer.....	\$ 18.14	0.00
PAINTER (Brush and Roller).....	\$ 15.68	0.00
PLUMBER.....	\$ 19.72	3.49
SPRINKLER FITTER (Fire Sprinklers).....	\$ 21.77	2.46
TRUCK DRIVER: Dump Truck.....	\$ 15.00	0.00

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

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

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

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

Union Rate Identifiers

A four-letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey.

Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

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

Survey Rate Identifiers

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

Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier. Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier. A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

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

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

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

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

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

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

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

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

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

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

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

=====

END OF GENERAL DECISION

Note: Please contact the Arkansas Economic Development Commission or project administrator, ten (10) days before the date of bid opening to confirm that the issued wage determination(s) is still valid. Modified or superseded wage determinations must be added to the contract.

Attachment 1-P
Bid Package for ACEDP Funded Projects
Architect's Certification of Compliance with Minimum Standards
for Access by Handicapped

ACEDP Project Number: 790-08998-17

Project Name: RANDOLPH COUNTY HEALTH UNIT

City/County, State: POCAHONTAS, AR 72455

Pursuant to the requirements of the Architectural Barriers Act of 1968, 42 USC 4151, and the regulations issued subsequent thereto, including the Americans with Disability Act, the undersigned certifies that the design of the above-referenced project is in conformance with the minimum standards contained in the American Standard Specifications for Making Buildings and Facilities Accessible To and Usable By the Physically Handicapped, Number A-117.1R-1971 (as modified by 41 CFR 101-19.603).

Name and Address of Project Architect:

MATT SILAS ARCHITECT
212 EAST WASHINGTON AVE.
JONESBORO, AR 72401

Registration Number: 3216

Signature:



Typed Name: MATT SILAS, AIA

Date: 10-26-20

Attachment 1-Q
Bid Package for ACEDP Funded Projects
Regulatory Requirements

1.1 Interest of Member or Delegate to Congress

No member of or Delegate to Congress, or Resident Commissioner, shall be a party to or benefit from this contract, except that provisions of this clause shall not extend to situations where the contract accrues to a corporation for its general benefit.

1.2 Equal Employment Opportunity

1.2.1 During the performance of this contract the contractor agrees as follows:

The contractor will not discriminate against any employee or applicant for employment because of age, race, religion, sex, color, handicap, veteran status or national origin. The contractor will take affirmative steps to ensure that applicants are employed, and that employees are treated during employment, without regard to their age, race, religion, sex, color, handicap, veteran status or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms or compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

1.2.2 The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, religion, sex, color, handicap, veteran status or national origin.

1.2.3 The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the labor union or workers representative of the contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965 (EO 11246), and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

The contractor will comply with all provisions of EO 11246, and of the rules, regulations, and relevant orders of the Secretary of Labor.

1.2.5 In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or Federally-assisted construction contracts.

1.2.6 The contractor will include the provisions of these paragraphs in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of EO 11246, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with

respect to any subcontract or purchase order as the Economic Development Commission and HUD may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by HUD, the contractor may request the United States to enter into such litigation to protect its interests.

1.3 Employment Practices

The contractor shall

1.3.1 To the greatest extent practicable, follow hiring and employment practices for work on the project, which will provide new job opportunities for the unemployed and underemployed (Section 3 requirements).

1.3.2 Insert or cause to be inserted the same provisions in each construction subcontract.

2.1 Special Equal Opportunity Provisions

2.1.1 **Activities and Contracts Not Subject to EO 11246, as Amended** (Applicable to Federally assisted construction contracts and related subcontracts *under \$10,000*). During the performance of this contract, the contractor agrees to incorporate the following requirements into all subcontracts:

2.1.1.1 The contractor shall not discriminate against any employee or applicant for employment because of age, race, religion, sex, color, handicap, veteran status or national origin. The contractor shall take affirmative steps to ensure that applicants for employment are employed, and that employees are treated during employment, with regard to their age, race, religion, sex, color, handicap, veteran status or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

2.1.1.2 The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided, setting forth the provision of this nondiscrimination clause. The notice shall state that all qualified applicants will receive consideration for employment without regard to age, race, religion, sex, color, handicap, veteran status or national origin.

2.2.1 **Contracts Subject to EO 11246, as Amended** (Applicable to Federally assisted construction contracts and related subcontracts *exceeding \$10,000*). During the performance of this contract, the contractor agrees as follows:

2.2.1.1 The contractor will not discriminate against any employee or applicant for employment because of age, race, religion, sex, color, handicap, veteran status or national origin. The contractor will take affirmative steps to ensure that applicants are employed, and that employees are treated during employment, without regard to their age, race, religion, sex, color, handicap, veteran status or national origin, Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer, recruitment

or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

- 2.2.1.2 The contractor will in all solicitations or advertisements for employees placed by or on his behalf, state that all qualified applicants will receive consideration for employment without regard to age, race, religion, sex, color, handicap, veteran status or national origin.
- 2.2.1.3 The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the labor union or workers' representatives of the contractor's commitments under this section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- 2.2.1.4 The contractor will comply with all provisions of EO 11246, and of the rules, regulations and relevant orders of the Secretary of Labor.
- 2.2.1.5 The contractor will furnish all information and reports required by EO 11246, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Arkansas Economic Development Commission, HUD, and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
- 2.2.1.6 In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract, or with any of such rules, regulations, or orders, this contract may be canceled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or Federally-assisted construction contracts.
- 2.2.1.7 The contractor will include all provisions of the seven paragraphs immediately above in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of EO 11246, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the Division may direct as a means of enforcing such provisions, including sanctions for noncompliance provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Division, the contractor may request the United States to enter into such litigation to protect its interests.

**"Section 3" Compliance in the Provision
of Training, Employment and Business Opportunities**

3.1.1 During the performance of this contract, the contractor agrees as follows:

3.1.1.1 The contractor agrees to comply with the requirements of Section 3 of the Housing and Urban Development Act of 1968, 12 USC 170 (u), as amended, the HUD regulations issued pursuant thereto at 24 CFR 135, and any applicable rules and orders of HUD issued thereunder.

3.1.1.2 The "Section 3 clause" set forth in 24 CFR 135.20 (b) shall form part of this contract, as set forth in the General Conditions.

3.1.1.3 Contractors shall incorporate the "Section 3 clause" shown below and the foregoing requirements in all subcontracts.

Section 3 Clause as Set Forth in 24 CFR 135.20(b)

The work to be performed under this contract is on a project funded with Federal financial assistance from HUD and is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 170(u). Section 3 requires that to the greatest extent feasible, opportunities for training and employment will be given to lower income residents of the project area and, contracts for work in connection with the project be awarded to business concerns which are located in or substantially owned by persons residing in the project area.

The parties to this contract will comply with the provisions of Section 3 and the regulations issued pursuant thereto by the Secretary of HUD set forth in 24 CFR 135, and all applicable rules and orders of the Division issued there under prior to the execution of this contract. The parties to this contract certify and agree that they are under no contractual or other disability, which would prevent them from complying with these requirements.

The contractor will send to each labor organization or workers' representative with which he has a collective bargaining agreement or other contract or understanding, a notice advising them of his commitments under Section 3 and will post copies of the notice in conspicuous places available to employees and applicants for employment or training.

The contractor will include this Section 3 clause in every subcontract for work in connection with the project and will, at the direction of the applicant for or recipient of Federal financial assistance, take appropriate action pursuant to the subcontract upon a finding that the subcontractor is in violation of regulations issued by HUD, 24 CFR 135. The contractor will not subcontract with any subcontractor where it has notice or knowledge that the latter has been found in violation of regulations under 24 CFR 135, and will not let any subcontract unless the subcontractor has first provided it with a preliminary statement of ability to comply with the requirements of these regulations.

Compliance with Section 3 provisions, the regulations set forth in 24 CFR 135, and all applicable rules and orders of the Division issued there under prior to the execution of the contract, shall be a condition of the Federal financial assistance provided to the project, binding upon the applicant or recipient for such assistance, its successors and assigns. Failure to fulfill these requirements shall subject the applicant or recipient, its contractors and

subcontractors, its successors, and assigns to those sanctions specified by the grant or loan agreement or contract through which Federal assistance is provided, and to such sanctions as are specified by 24 CFR 135.

4.1 Access to Records/Maintenance of Records

The contractor shall maintain accounts and records, including personnel, property, and financial records, adequate to identify and account for all costs pertaining to the contract and such other records as may be deemed necessary by the locality to assure proper accounting for all funds. These records will be available for audit purposes to the locality or the State or any other authorized representative, and will be retained for three years after contract completion. Moreover, the locality, State, or any authorized representative shall have access to any books, documents, papers, and records of the contractor which are directly pertinent to this contract for the purpose of making audit, examination, excerpts, and transcriptions.

5.1 Conflict of Interest of Officers or Employees of the Local Jurisdiction, Members of the Local Governing Body, or Other Public Officials

No officer or employee of the local jurisdiction or its designees or agents, no member of the governing body, and no other public official of the locality who exercises any function or responsibility with respect to this contract, during his/her tenure or for one year thereafter, shall have any interest, direct or indirect, in any contract or subcontract, or the proceeds thereof, for work to be performed. Further, the contractor shall cause to be incorporated in all subcontracts the language set forth in this paragraph prohibiting conflict of interest.

6.1 Section 503 of the Rehabilitation Act of 1973 (If \$2,500 or Over)

6.1.1 The contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for employment is qualified. The contractor agrees to take affirmative steps to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as the following: employment upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

6.1.2 The contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

6.1.3 In the event of the contractor's noncompliance with the requirements of this clause, actions for noncompliance may be taken in accordance with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

6.1.4 The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices stating the contractor's obligation under the law to take affirmative steps to employ and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.

6.1.5 The contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement of other contract understanding, that the

contractor is bound by the terms of Section 503 of the Rehabilitation Act of 1973, and is committed to take affirmative steps to employ and advance in employment physically and mentally handicapped individuals.

6.1.6 The contractor will include the provisions of this clause in every subcontract or purchase order of \$2,500 or more unless exempted by rules, regulations, or orders of the Secretary issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the Director of the office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for noncompliance.

7.1 Section 402 Veterans Readjustment Assistance Act of 1973 (If \$10,000 or Over)

7.1.1 Affirmative Steps for Disabled Veterans and Veterans of the Vietnam Era

7.1.1.1 The contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran or veteran of the Vietnam era in regard to any position for which the employee or applicant for employment is qualified. The contractor agrees to take affirmative steps to employ, advance in employment and otherwise treat qualified disabled veterans and veterans of the Vietnam era without discrimination based upon their disability or veteran status in all employment practices such as the following: employment upgrading, demotion or transfer, recruitment, advertising, layoff or termination, and selection for training, including apprenticeship.

7.1.1.2 The contractor agrees that all suitable employment openings which exist at the time the contract is executed and those which occur during the performance of this contract (including those not generated by this contract and including those occurring at an establishment of the contractor other than the one wherein the contract is being performed but excluding those of independently operated corporate affiliates) shall be listed at an appropriate local office of the State employment service system wherein the opening occurs. The contractor further agrees to provide reports to local offices regarding employment openings and hires as may be requested.

7.1.1.3 State and local government agencies holding Federal contracts of \$10,000 or more shall also list all their suitable openings with the appropriate office of the State employment service.

7.1.1.4 Listing of employment openings with the employment service system pursuant to this clause shall be made at least concurrently with the use of any other recruitment source or effort and shall involve the normal obligations which attach to the placing of a bona fide job order, including the acceptance of referrals of veterans and non-veterans. The listing of employment openings does not require the hiring of any particular job applicant or selection from any particular group of job applicants, and nothing herein is intended to relieve the contractor from any requirements in Executive Orders or regulations regarding nondiscrimination in employment.

- 7.1.1.5 The reports required in regard to this clause shall include, but not be limited to, periodic reports which shall be filed at least quarterly with the appropriate local office, or where the contractor has more than one hiring location in a State, with the central office of that State employment service. Such reports shall indicate for each hiring location (1) the number of individuals hired during the reporting period, (2) the number of nondisabled veterans of the Vietnam era hired, (3) the number of disabled veterans of the Vietnam era hired, and (4) the total number of disabled veterans hired for on-the-job training under 38 U.S.C. 1787. The contractor shall submit a report within 30 days after the end of each reporting period wherein any performance is made of this contract identifying data for each hiring location. The contractor shall maintain at each hiring location copies of the reports submitted until the expiration of one year after final payment under the contract, during which time these reports and related documentation shall be made available, upon request, for examination by any authorized representative of the contracting officer for of the Secretary of Labor. Documentation would include personnel records respecting job openings, recruitment and placement.
- 7.1.1.6 Whenever the contractor is subject to the listing provisions of this clause, it shall advise the employment service system in each State where it has establishments of the name and location of each hiring location in the State. As long as the contractor is subject to these provisions and has so advised the State system, there is no need to advise them of subsequent contracts. The contractor may inform the State system when it is no longer bound by this contract clause.
- 7.1.1.7 This clause does not apply to the listing of employment openings occurring and filled outside the 50 States, the District of Columbia, Puerto Rico, Guam and the Virgin Islands.
- 7.1.1.8 The provisions of this clause do not apply to openings, which the contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union firing arrangement. This exclusion does not apply to a particular opening since an employer decides to consider applicants outside of his own organization or employer-union arrangement for that opening.
- 7.1.1.9 The phrase "All suitable employment openings" includes, but is not limited to, openings which occur in the following job categories; production and nonproduction; plans and office; laborers and mechanics; supervisory and nonsupervisory; technical; and executive administrative and professional openings compensated on a salary basis of less than \$25,000 per year. This term includes full-time employment, temporary employment of more than 3 days' duration, and part-time employment. It does not include openings which the contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement nor openings in an educational institution which are restricted to students of the institution. Under the most compelling circumstances, an employment opening may not be suitable for listing, including such situations where the needs of the Government cannot reasonably be

otherwise supplied, where listing would be contrary to national security, or where the requirement of listing would otherwise not be for the best interest of the Government.

- 7.1.1.10 "Appropriate office of the State employment service system" means the local office of the Federal-State national system of public employment offices with assigned responsibility for serving the area where the employment openings are to be filled, including the District of Columbia, Guam, Puerto Rico, and the Virgin Islands.
- 7.1.1.11 "Openings which the contractor proposes to fill from within his own organization" means employment openings for which no consideration will be given to persons outside the contractor's organization (including any affiliates, subsidiaries, and the parent companies) and includes any openings which the contractor proposes to fill from regularly established "recall" lists.
- 7.1.1.12 "Openings, which the contractor proposes to fill pursuant to a customary and traditional employer-union, hiring arrangement," means employment openings, which the contractor proposes to fill from union halls, which is part of the customary and traditional hiring relationship, which exists between the contractor and representative of his employees.
- 7.1.1.13 The contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.
- 7.1.1.14 In the event of the contractor's noncompliance with the requirements of this clause, actions for noncompliance may be taken in accordance with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.
- 7.1.1.15 The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by or through the contracting officer. Such notices shall state the contractor's obligation under the law to take affirmative steps to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era for employment, and the rights of applicants and employees.
- 7.1.1.16 The contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the contractor is bound by the terms of the Vietnam Era Veterans Readjustment Assistance Act, and is committed to take affirmative steps to employ and advance in employment qualified disabled veterans and veterans of the Vietnam Era.
- 7.1.1.17 The contractor will include the provisions of this clause in every subcontract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary issued pursuant to the Act, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase

order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for noncompliance.

8.1 **Section 109 of the Housing and Community Development Act of 1974**

- 8.1.1 No person in the United States shall on the ground of race, color, national origin, or sex be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity funded in whole or in part with funds made available under this title.
- 8.1.2 Whenever the Secretary of HUD determines that a State or unit of general local government which is a recipient of assistance under this title has failed to comply with subsection 8.1.1 or an applicable regulation, he shall notify the Governor of such State or the chief executive officer of such unit of local government of the noncompliance and shall request the Governor or the chief executive officer to secure compliance. If within a reasonable period of time, not to exceed sixty days, the Governor or the chief executive officer fails or refuses to secure compliance, the Secretary is authorized to (1) refer the matter to the Attorney General with a recommendation that an appropriate civil action be instituted; (2) exercise the powers and functions provided by Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d); (3) exercise the powers and functions provided for in section 111 (a) of this Act; or (4) take such other action as may be provided by law.
- 8.1.3 When a matter is referred to the Attorney General pursuant to above, or whenever he has reason to believe that a State government or unit of general local government is engaged in a pattern or practice in violation of the provisions of this section, the Attorney General may bring a civil action in any appropriate United States court for such relief as may be appropriate, including injunctive relief.

9.1 **Civil Rights Act of 1964**

- 9.1.1 Under Title VI of the Civil Rights Act of 1964, no person shall, on the grounds of race, color, sex, or national origin, be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving Federal financial assistance. Subsequent civil rights legislation has extended nondiscrimination to classes based on age and handicap.

10.1 **Certification of Compliance with Air and Water Acts**

(Applicable to Federally-assisted construction contracts and related subcontracts exceeding \$100,000)

- 10.1.1 During the performance of this contract, the contractor and all subcontractors shall comply with the requirements of the Clean Air Act, as amended, 42, USC 1857 et seq., the Federal Water Pollution Control Act, as amended, 33 USC 1251 et seq., and the regulations of the Environmental Protection Agency with respect thereto, at 40 CFR 15, as amended.
- 10.1.2 In addition to the foregoing requirements, all nonexempt contractors and subcontractors shall furnish to the owner, the following:

A stipulation by the contractor or subcontractors, that any facility to be utilized in the performance of any nonexempt contract or subcontract, is not listed on the List of Violating Facilities issued by the Environmental Protection Agency (EPA) pursuant to 40 CFR 15.20.

Agreement by the contractor to comply with all the requirements of Section 114 of the Clean Air Act, as amended, (42 USC 1857 c-8) and Section 308 of the Federal Water Pollution Control Act, as amended, (33 USC 1318) relating to inspection, monitoring, entry, reports and information, as well as all other requirements specified in said Section 114 and Section 308, and all regulations and guidelines issued thereunder.

A stipulation that as a condition of contract award, prompt notice will be given of any notice received from the Director, Office of Federal Activities, EPA, indicating that a facility utilized, or to be utilized for the contract, is under consideration to be listed on the EPA List of Violating Facilities.

Agreement by the contractor that he will include, or cause to be included, the criteria and requirements in 10.1.2.1 to 10.1.2.4 of this section in every subcontract and requiring that the contractor take enforcement action as the Government

11.1 Hazards, Safety Standards and Accident Prevention

11.1.2 Use of Explosives

11.1.2.1 When the use of explosives is necessary for the prosecution of the work, the contractor shall observe all local, State and Federal laws in purchasing and handling explosives and take all necessary precaution to protect completed work, neighboring property, waterlines, or other underground structures. Where there is danger to structures or property from blasting, the charges shall be reduced and the material covered with suitable timber, steel or rope mats. The contractor shall notify all owners of public utility property of intention to use explosives at least 8 hours before blasting is done, close to such property.

11.1.3 Danger Signals and Safety Devices (Modify as Required)

11.1.3.1 The contractor shall take all necessary precautions to guard against damages to property and injury to persons. He shall put up and maintain in good condition, sufficient red or warning lights at night, suitable barricades and other devices necessary to protect the public. In case the contractor fails or neglects to take such precautions, the Owner may have such lights and barricades installed and charge the cost of this work to the contractor. Such action by the Owner does not relieve the contractor of any liability incurred under these specifications or contract.

12.1 Or Equal Clause

Whenever a material, article or piece of equipment is identified on the plans or specifications by reference to manufacturers' or vendors' names, trade names, catalogue numbers, etc., it is intended merely to establish a standard; and any material, article, or equipment of other manufacturers and vendors which will perform adequately the duties imposed by the general

design will be considered equally acceptable provided the material, article, or equipment so proposed, meets State plumbing requirements as equal in substance or structure.

FEDERAL LABOR STANDARDS PROVISIONS

U.S. Department of Housing and Urban Development
Office of Labor Relations Previous editions are obsolete
Form HUD-4010 (06/2009) ref. Handbook 1344.1

Applicability

The Project or Program to which the construction work covered by this contract pertains is being assisted by the United States of America and the following Federal Labor Standards Provisions are included in this Contract pursuant to the provisions applicable to such Federal assistance.

A. 1. (i) Minimum Wages. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period.

Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under 29 CFR 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible, place where it can be easily seen by the workers.

(ii) (a) Any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. HUD shall approve an additional classification and wage rate and fringe benefits therefor only when the following criteria have been met:

- (1)** The work to be performed by the classification requested is not performed by a classification in the wage determination; and
- (2)** The classification is utilized in the area by the construction industry; and
- (3)** The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(b) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and HUD or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent

by HUD or its designee to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB control number 1215-0140.)

(c) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and HUD or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), HUD or its designee shall refer the questions, including the views of all interested parties and the recommendation of HUD or its designee, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

(d) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii)(b) or (c) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part Previous editions are obsolete Page 2 of 5 form HUD-4010 (06/2009) ref. Handbook 1344.1 of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

2. Withholding. HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract In the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper, employed or working on the site of the work, all or part of the wages required by the contract, HUD or its designee may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased. HUD or its designee may, after written notice to the contractor, disburse such amounts withheld for and on account of the contractor or subcontractor to the respective employees to whom they are due. The Comptroller General shall make such disbursements in the case of direct Davis-Bacon Act contracts.

3. (i) Payrolls and basic records. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in Section 1(b)(2)(B) of the Davis-bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5 (a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs. (Approved by the Office of Management and Budget under OMB Control Numbers 1215-0140 and 1215-0017.)

(ii) (a) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to HUD or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the case may be, for transmission to HUD or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i) except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to HUD or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the case may be, for transmission to HUD or its designee, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this subparagraph for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to HUD or its designee. (Approved by the Office of Management and Budget under OMB Control Number 1215-0149.)

(b) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under 29 CFR 5.5 (a)(3)(ii), the appropriate information is being maintained under 29 CFR 5.5(a)(3)(i), and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either

directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(c) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph A.3.(ii)(b).

(d) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under subparagraph A.3.(i) available for inspection, copying, or transcription by authorized representatives of HUD or its designee or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, HUD or its designee may, after written notice to the contractor, sponsor, applicant or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and Trainees.

(i) **Apprentices.** Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator

determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under 29 CFR Part 5 shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR Part 3 which are incorporated by reference in this contract

6. Subcontracts. The contractor or subcontractor will insert in any subcontracts the clauses contained in subparagraphs 1 through 11 in this paragraph A and such other clauses as HUD or its designee may by appropriate instructions require, and a copy of the applicable prevailing wage decision, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in this paragraph.

7. Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act Requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and HUD or its designee, the U.S. Department of Labor, or the employees or their representatives.

10. (i) Certification of Eligibility. By entering into this contract the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001. Additionally, U.S. Criminal Code, Section 1 01 0, Title 18, U.S.C., "Federal Housing Administration transactions", provides in part: "Whoever, for the purpose of . . . influencing in any way the action of such Administration..... makes, utters or publishes any statement knowing the same to be false..... shall be fined not more than \$5,000 or imprisoned not more than two years, or both."

11. Complaints, Proceedings, or Testimony by Employees. No laborer or mechanic to whom the wage, salary, or other labor standards provisions of this Contract are applicable shall be discharged or in any other manner discriminated against by the Contractor or any subcontractor because such employee has filed any complaint or instituted or caused to be instituted any proceeding or has testified or is about to testify in any proceeding under or relating to the labor standards applicable under this Contract to his employer.

B. Contract Work Hours and Safety Standards Act. The provisions of this paragraph B are applicable where the amount of the prime contract exceeds \$100,000. As used in this paragraph, the terms "laborers" and "mechanics" include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in subparagraph (1) of this paragraph, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in subparagraph (1) of this paragraph, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by the clause set forth in sub paragraph (1) of this paragraph.

3) Withholding for unpaid wages and liquidated damages. HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contract, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the same prime contractor such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph (2) of this paragraph.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraph (1) through (4) of this paragraph and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in subparagraphs (1) through (4) of this paragraph.

C. Health and Safety. The provisions of this paragraph C are applicable where the amount of the prime contract exceeds \$100,000.

(1) No laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health and safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation.

(2) The Contractor shall comply with all regulations issued by the Secretary of Labor pursuant to Title 29 Part 1926 and failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act, (Public Law 91-54, 83 Stat 96). 40 USC 3701 et seq.

(3) The contractor shall include the provisions of this paragraph in every subcontract so that such provisions will be binding on each subcontractor. The contractor shall take such action with respect to any subcontractor as the Secretary of Housing and Urban Development or the Secretary of Labor shall direct as a means of enforcing such provisions.

Attachment 1-R
Bid Package for ACEDP Funded Projects
Enumeration of Plans, Specifications and Addenda

Following are the Plans, Specifications and Addenda which form a part of this contract, as set forth in the General Conditions, "Contract and Contract Documents":

Plans/Drawings

As listed in Section 00 0115 – LIST OF DRAWING SHEET - of the Specification Manual.

Specifications

As listed in Section 00 0110 – TABLE OF CONTENTS - of the Specification Manual.

Addenda

No. _____ Date _____ No. _____ Date _____
No. _____ Date _____ No. _____ Date _____

STATED ALLOWANCES

Pursuant to the General Conditions, the contractor shall include the following cash allowances in his proposal:

- For _____ (Page ___ of Specifications) \$ _____
- For _____ (Page ___ of Specifications) \$ _____
- For _____ (Page ___ of Specifications) \$ _____
- For _____ (Page ___ of Specifications) \$ _____
- For _____ (Page ___ of Specifications) \$ _____
- For _____ (Page ___ of Specifications) \$ _____

Special Hazards

The Contractor's and his Subcontractor's Public Liability and Property Damage Insurance shall provide adequate protection against the following special hazards:

No Special Hazards Listed.

**Contractor's and Subcontractor's Public Liability,
Vehicle Liability and Property Damage Insurance**

As required in the General conditions, the Contractor's Public Liability Insurance and Vehicle Liability Insurance shall be in an amount not less than \$ _____ for injuries, including accidental death, to any one person, and subject to the same limit for each person, in an amount not less than \$ _____ on account of one accident, and Contractor's Property Damage Insurance in an amount not less than \$ _____.

The Contractor shall either require each of his subcontractors to procure and to maintain during the life of his subcontract, Subcontractor's Public Liability and Property Damage of the type and in the same amounts as specified in the preceding paragraph, or insure the activities of his subcontractors in his own policy.

Photographs of Project

As provided in the General Conditions, the Contractor will furnish photographs in the number, type, and stage as enumerated below:

**Schedule of Occupational Classifications and Minimum Hourly
Wage Rates as Required in the General Conditions**

Given on Pages 33 and 34 in this document.

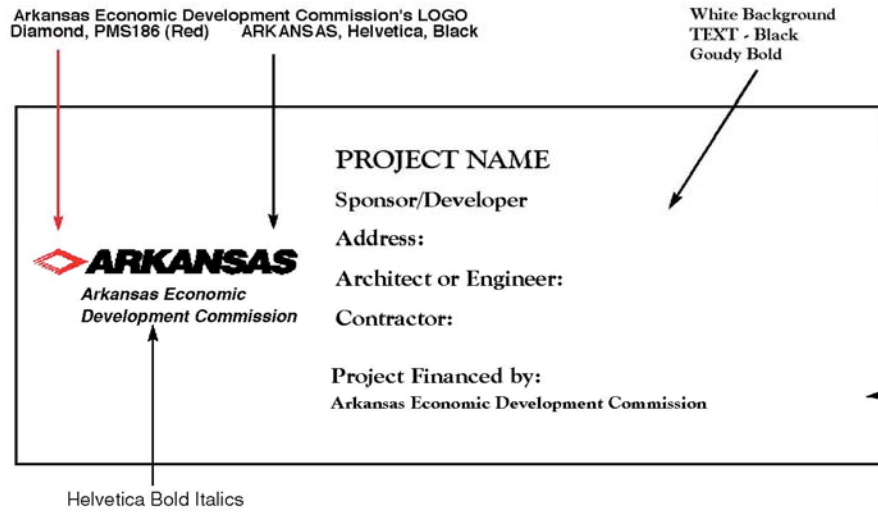
Builder's Risk Insurance

As provided in Bonds and Certificates, the Contractor will maintain Builder's Risk Insurance (fire and extended coverage) on a 100 percent completed value basis on the insurable portions of the project for the benefit of the Owner, the Contractor, and all subcontractors, as their interests may appear.

Attachment 1-S
Bid Package for ACEDP Funded Projects
Technical Specifications of the Contract

Any technical specification of the contract, so desired by the Owner, in addition to the preceding specified contract documents shall be entered below.

Attachment 1-T
Bid Package For ACEDP Funded Projects
ACEDP Project Sign Specifications



SIGN DIMENSIONS: Approximately 4' x 8' x 3/4" * PLYWOOD PANEL (APA Rated A-B grade exterior)

Construction Management-83
(1999)

Form 121
Attachment 1-U
Certificate of Compliance for the 2014 Arkansas Energy Code
Design Professional

I, the undersigned, Matt Silas, AIA, the duly authorized licensed design professional of record for the Randolph County Health Unit, located at Camp Road, in Pocahontas, Arkansas, certify that the aforementioned building is designed to meet and or exceed the minimum requirements of the 2014 Arkansas Energy Code and building specifications, based on the requirements, have been provided to me by the licensed design professional(s) of record.

Matt C. Silas, AIA

Signature

3216
License Number

10-26-20
Date



Stamp

Per legislative authority provided by in Section 3(B)(2)(c) of Act 7 of 1981

For information regarding the specifications and requirements of the 2004 Arkansas Energy Code, contact the Arkansas Energy Office at 1-800-558-2633 or find related materials and resources at www.arkansasenergy.org .

Form 122
Attachment 2U
Certificate of Compliance for the 2014 Arkansas Energy Code
Builder / Contractor

I, the undersigned, _____, the duly authorized licensed builder/contractor of record for the **Randolph County Health Unit**, located at **Camp Road**, in **Pocahontas, Arkansas**, certify that the aforementioned building is constructed to meet and or exceed the minimum requirements of the 2014 Arkansas Energy Code and building specifications, based on the requirements that have been provided to me by the design professional(s) of record.

Signature

License Number

Date

Per legislative authority provided by in Section 3(B)(2)(c) of Act 7 of 1981

For information regarding the specifications and requirements of the 2004 Arkansas Energy Code, contact the Arkansas Energy Office at 1-800-558-2633 or find related materials and resources at www.arkansasenergy.org .

Form 123
Attachment V
DISCLOSURE REQUIRED BY EXECUTIVE ORDER 98-04

Contracts and Grants

Any contract or amendment to a contract or any grant executed by an agency which exceeds \$25,000 shall require the contractor to disclose information as required under the terms of Executive Order 98-04 and the Regulations pursuant thereto.

Any individual contracting with the State of Arkansas shall disclose if he or she is a current or former: member of the general assembly, constitutional officer, board or commission member, state employee, or the spouse or immediate family of any of the persons as described herein.

Any entity contracting with the State of Arkansas shall disclose

- (a) any position of control, or
- (b) any ownership interest of 10% or greater

that is held by a current or former: member of the general assembly, constitutional officer, board or commission member, state employee, or the spouse or immediate family of any of the persons as described herein.

Disclosure by Sub-contractor or Assignee

Any sub-contractor or assignee (hereinafter "Third Party") shall disclose whether such Third Party is a current or former: member of the general assembly, constitutional officer, board or commission member, state employee, or the spouse or immediate family member of any of the persons as described herein, or if any of the persons here described in this sentence hold any position of control or ownership interest of 10% or greater in the Third Party. This disclosure requirement shall apply during the entire term of the contract or grant, without regard to whether the subcontract or assignment is entered into prior or subsequent to the date of contract or grant.

Failure to Disclose and Violations

The failure of any person or entity to disclose as required under any term of Executive Order 98-04, or the violation of any rule, regulation or policy promulgated by the Department of Finance and Administration pursuant to this Order, shall be considered a material breach of the terms of the contract or grant and shall subject the party failing to disclose or in violation to all legal remedies available to the state agency under the provision of existing law.

Please check all that apply if you are a current or former:

_____ Member of the General Assembly of the State of Arkansas

_____ Constitutional Officer of the State of Arkansas

_____ Member of a Board or Commission of the State of Arkansas

_____ State Employee

_____ Spouse of a current or former member of the general assembly, constitutional officer, board or commission member, or state employee.

_____ I am a current or former: member of the general assembly, constitutional officer, board or commission member, state employee, or spouse or immediate member of these persons as described, and I hold a position of control in the contracting entity or grantee of this application.

_____ I am a current or former: member of the general assembly, constitutional officer, board or commission member, state employee, or spouse or immediate member of these persons as described, and I hold a 10% or higher interest in the contracting entity or grantee of this application.

I hereby acknowledge that failure to disclose the information as required by Executive Order 98-04 shall constitute a material breach of any future agreement, resulting from this application, with the State of Arkansas or any state agency acting on its behalf.

I also acknowledge that any individual drawing a salary or performing personal services for an agency must disclose any direct or indirect benefit he or she may receive as a result of any State contract with an entity in which he or she has a financial interest. I understand that failure to report this information may subject me to criminal sanctions, as provided in Ark. Code Ann. §19-11-702.

Name

Date

Attachment 1-W
System for Award Management (SAM) Certification Instructions

Grantee Name: Randolph County Judge David Jansen

ACEDP Project No.: 790-08998-17

In accordance with the General Service Administration's (GSA) Office of Government wide Policy, Cities, Counties, Contractors and Professional Service providers MUST be registered with the System for Award Management (SAM) prior to obtaining a contract and/or agreement with a project receiving Federal and/or State funding. The System for Award Management (previously known as CCR-Central Contractor Registration) is a database that is used to collect, validate, store and disseminate data in support of Federal and State agency contracts and assistance awards.

SAM registrants must provide basic information relevant to procurement and financial transactions in order to complete their registration. Registrants must update or renew their registration at least once a year to maintain an active status. An active status must be maintained for the life of the contract and/or agreement.

In order to register with SAM, you must have a Data Universal Numbering System (DUNS) number. There is NO CHARGE for obtaining a DUNS number or for registering in SAM. A DUNS number can be obtained at www.dnb.com or call 800-424-2495. SAM has a FREE online registration process that can be accessed at www.sam.gov.

Verification of the City's, County's, Contractor's and/or Professional Services Provider's active SAM registration must be obtained prior to execution of all agreements and contracts. If you have questions or need additional information, please go to the SAM website or call the Federal Service Desk at 866-606-8220. You may also contact your Grant Administrator for additional assistance. Attach printout of SAM eligibility.

NOTE: Verification that you are registered and active in SAM.gov MUST be presented at the Pre-Construction Conference or the Notice to Proceed will not be issued.

**SECTION 00 2113
INSTRUCTIONS TO BIDDERS**

INVITATION

1.01 BID SUBMISSION

- A. Bids signed and under seal, executed and dated will be received by the owner at the time and place listed in Section 00 1100 ACEDP Bid Package for General Contractors.

1.02 INTENT

- A. The intent of this Bid request is to obtain an offer to perform work for a Stipulated Sum contract, in accordance with the Contract Documents.

1.03 BID DOCUMENTS AND CONTRACT DOCUMENTS

1.04 DEFINITIONS

- A. Bid Documents: Contract Documents supplemented with Invitation To Bid, Instructions to Bidders, Information Available to Bidders, Bid Form Bid securities identified.
- B. Contract Documents: Defined in AIA A201 Article 1 including issued Addenda.
- C. Bid, Offer, or Bidding: Act of submitting an offer under seal.
- D. Bid Amount: Monetary sum identified by the Bidder in the Bid Form.

1.05 CONTRACT DOCUMENTS IDENTIFICATION

- A. The Contract Documents consists of documents prepared by the Architect and the Architect's consultants.

1.06 INQUIRIES / ADDENDA

- A. Questions shall be directed as follows:
 - 1. 1. Matt Silas Architect: Architectural and Engineering Documents.
- B. Addenda may be issued during the bidding period. All Addenda become part of the Contract Documents. Include resultant costs in the Bid Amount.
- C. Verbal answers are not binding on any party.
- D. Clarifications requested by bidders must be in writing not less than 7 days before date set for receipt of bids. The reply will be in the form of an Addendum, a copy of which will be forwarded to known recipients and others requesting such information.

1.07 PRODUCT /ASSEMBLY / SYSTEM SUBSTITUTIONS

- A. Where the Bid Documents stipulate a particular product, substitutions will be considered up to 5 days before receipt of bids.
- B. When a request to substitute a product is made, Matt Silas Architect may approve the substitution and will issue an Addendum to known bidders.
- C. The submission shall provide sufficient information to determine acceptability of such products.
- D. Provide complete information on required revisions to other work to accommodate each proposed substitution.
- E. Provide products as specified unless substitutions are submitted in this manner and accepted.
- F. See Section 01 6000 - Product Requirements for additional requirements.

1.08 SITE ASSESSMENT

1.09 EXAMINATION

- A. The bidder is encouraged to visit the project site prior to submitting a bid.

1.10 SUBCONTRACTORS / SUPPLIERS / OTHERS

- A. The Owner reserves the right to reject a proposed subcontractor for reasonable cause.

1.11 BID SUBMISSION

1.12 SUBMISSION PROCEDURE

- A. Refer to Section 00 1100 AECDP Bid Package for General Contractors.
- B. Submit one copy of the executed offer on the Bid Forms provided, signed and sealed with the required security in a closed opaque envelope, clearly identified with bidder's name, project name and Owner's name on the outside.
- C. Improperly completed information, irregularities in bid bond, may be cause not to open the Bid Form envelope and declare the bid invalid or informal.

1.13 BID INELIGIBILITY

- A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, will at the discretion of the Owner, be declared unacceptable.
- B. Bid Forms, Appendices, and enclosures that are improperly prepared will, at the discretion of the Owner, be declared unacceptable.
- C. Failure to provide security deposit, bonding or insurance requirements will, at the discretion of the Owner, be waived.

1.14 PERFORMANCE ASSURANCE

- A. Accepted Bidder: Provide a Performance and Payment bond as described in Document 00 7300 - Supplementary Conditions and Section 00 1100 AECDP Bid Package for General Contractors.

1.15 INSURANCE

- A. Provide an executed "Undertaking of Insurance" on a standard form provided by the insurance company stating their intention to provide insurance to the bidder in accordance with the insurance requirements of the Contract Documents.

1.16 BID FORM SIGNATURE

- A. The Bid Form shall be signed by the bidder, as follows:
 - 1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature. Affix seal.
 - 2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature. Affix seal to each signature.
 - 3. Corporation: Signature of a duly authorized signing officer(s) in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the bid is signed by officials other than the president and secretary of the company, or the president/secretary/treasurer of the company, a copy of the by-law resolution of their board of directors authorizing them to do so, must also be submitted with the Bid Form in the bid envelope.

1.17 ADDITIONAL BID INFORMATION

- A. Submit the following Supplements concurrent with bid submission:
 - 1. Document 00 4336 - Supplement A - Subcontractors: Include the names of all Subcontractors and the portions of the Work they will perform.

1.18 OFFER ACCEPTANCE / REJECTION

- A. DURATION OF OFFER
 - 1. Bids shall remain open to acceptance and shall be irrevocable for a period of thirty (30) days after the bid closing date.
- B. ACCEPTANCE OF OFFER
 - 1. The Owner reserves the right to accept or reject any or all offers.

2. After acceptance by the Owner, Matt Silas Architect on behalf of the Owner, will issue to the successful bidder, a written Notice To Proceed.

END OF SECTION

SECTION 00 3100
AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

- A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders but will not be part of Contract Documents, as follows:
- B. Geotechnical Report: Entitled Geotechnical Investigation for Randolph County Health Unit, Pocahontas, Arkansas, dated December 31, 2020 prepared by Anderson Engineering Consultants, Inc.
 - 1. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
 - 2. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in Contract Documents.
 - 3. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Sum accruing to Owner.
 - 4. The full report is attached.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION



ANDERSON ENGINEERING CONSULTANTS, INC.

10205 W ROCKWOOD ROAD
LITTLE ROCK, AR 72204
(501) 455-4545

3217 NEIL CIRCLE
JONESBORO, AR 72401
(870) 932-3700

620 E 3RD STREET
HOPE, AR 71801
(501) 515-4654

**GEOTECHNICAL INVESTIGATION
FOR
PROPOSED RANDOLPH COUNTY HEALTH UNIT
POCAHONTAS, ARKANSAS**

* * * * *

**MATT SILAS, ARCHITECT
ARCHITECTS
212 EAST WASHINGTON AVENUE
JONESBORO, ARKANSAS 38017**

* * * *

DECEMBER 31, 2020

JOB NO. 16686





ANDERSON ENGINEERING CONSULTANTS, INC.

10205 W ROCKWOOD ROAD
LITTLE ROCK, AR 72204
(501) 455-4545

3217 NEIL CIRCLE
JONESBORO, AR 72401
(870) 932-3700

620 E 3RD STREET
HOPE, AR 71801
(501) 515-4654

December 31, 2020

Job No. 16686

Mr. Matt Silas, AIA
Matt Silas, Architect
212 East Washington Avenue
Jonesboro, Arkansas 72403

Re: Geotechnical Investigation
Proposed Randolph County Health Unit
Pocahontas, Arkansas

Dear Mr. Silas:

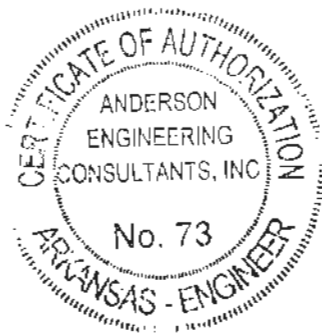
It is our pleasure to submit this report on the soil and foundation investigation for the proposed Randolph County Health Unit in Pocahontas, Arkansas. The investigation consisted of field test borings, soils laboratory analyses, foundation and pavement design analyses.

We recommend that our geotechnical services be continued in the construction phase of the project for this is the most feasible means of assuring the owners, designers, and builders that the geotechnical design intent is being achieved. In the event that adverse geotechnical conditions are encountered during construction, they can be identified and evaluated, and prompt remedial measures can be taken during construction.

We wish to express our appreciation for the opportunity of serving you and other members of the design team. We are available for further consultation during the design and construction at any time, should you have a need for further assistance.

Very truly yours,

ANDERSON ENGINEERING CONSULTANTS, INC.



Stuart M. Scheiderer, R.E.P., P.E.
Senior Geotechnical Engineer

Scott W. Anderson, R.E.P., P.E.
Principal Engineer



SMS/SWA/llb
16686.GEO

GEOTECHNICAL INVESTIGATION
FOR
PROPOSED RANDOLPH COUNTY HEALTH UNIT
POCAHONTAS, ARKANSAS

* * * * *

MATT SILAS, ARCHITECT
ARCHITECTS
212 EAST WASHINGTON AVENUE
JONESBORO, ARKANSAS 38017

* * * * *

BY
ANDERSON ENGINEERING CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
10205 ROCKWOOD ROAD
LITTLE ROCK, ARKANSAS 72204

DECEMBER 31, 2020

JOB NO. 16686

TABLE OF CONTENTS

<u>TEXT</u>	<u>PAGE</u>
Important Information About Your Geotechnical Engineering Report	i
Purpose	1
Scope	1
Authority	1
Project Description	2
Regional Geology	2
Field Investigation	2
Groundwater Conditions	3
Site Drainage	3
Seismicity	4
Laboratory Testing	4
Earthwork	5
Pre-Construction Considerations	5
Site Preparation	6
Fill Placement	6
Excavation Criteria	7
Landscaping/Hardscaping	7
Adverse Weather Conditions	8
Foundations	8
Bearing Capacity	9
Settlement	9
Other Design Considerations	9
Excavation/Monitoring	10
Floor Slabs	10
Subgrade Preparation	10
Granular Base	11
Vapor Membrane	11
Drives and Parking Areas	11
Flexible Pavement	12
Rigid Pavement	12
Pavement Performance/Maintenance	13
Quality Control	13
Conclusions and Recommendations	14
Limitations	14
 <u>APPENDIX A</u>	 <u>PLATE</u>
Vicinity Map	1
Plan of Borings	2
Logs of Borings	3 - 7
Field Classification System for Soil Exploration	8
Field Identification System for Rocks	9
Key to Soil Classifications and Symbols	10
Consolidated Geologic Formations	11
Unified Soil Classification System	12
Recommended Flexible and Rigid Pavement Structures	13
 <u>APPENDIX B</u>	 <u>PLATE</u>
Moisture Content Determination (ASTM D 2216)	B1
Atterberg Limit Determination (ASTM D 4318)	B2
Mechanical Grain Size Analysis (ASTM D 1140)	B3 - B5
Shrinkage/Swell Index Tests	B6

Important Information about Your Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply the report for any purpose or project except the one originally contemplated.*

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time to perform additional study.* Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that

have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention.*** ***Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance

Membership in ASFE/THE BEST PEOPLE ON EARTH exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.



8811 Colesville Road/Suite G106, Silver Spring, MD 20910

Telephone: 301/565-2733 Facsimile: 301/589-2017

e-mail: info@asfe.org www.asfe.org

Copyright 2004 by ASFE, Inc. Duplication, reproduction, or copying of this document, in whole or in part, by any means whatsoever, is strictly prohibited, except with ASFE's specific written permission. Excerpting, quoting, or otherwise extracting wording from this document is permitted only with the express written permission of ASFE, and only for purposes of scholarly research or book review. Only members of ASFE may use this document as a complement to or as an element of a geotechnical engineering report. Any other firm, individual, or other entity that so uses this document without being an ASFE member could be committing negligent or intentional (fraudulent) misrepresentation.

PURPOSE

The primary purposes of this geotechnical investigation were:

- a. To determine the physical and engineering properties of the soils within the area of the proposed construction with respect to their suitability for the support of the proposed facility.
- b. To make recommendations for the earthwork, the type of foundation and pavement suited for the prevailing soil conditions within the proposed construction area.
- c. To evaluate and recommend the design procedures for the various soil, foundation and pavement items in accordance with current engineering practices.

SCOPE

The scope of this geotechnical investigation includes the following:

- a. The geologic features of the job site area consist typically of shallow terrace and alluvial deposits overlying dolomite. The site stratigraphy was defined by five auger borings terminated at depths ranging from 6.5 to 15.0 feet (auger refusal).
- b. Field testing consisted of Standard Penetration test samples (ASTM D 1586) taken in all of the borings. Soils were visually classified in the field by a soils engineering technician.
- c. The soils analyses were based on N-values obtained from the Standard Penetration tests, moisture contents, Atterberg limits, mechanical grain size analyses, visual observations, and other routine inspection and classification methods. The soils were classified basically in accordance with the Unified Soil Classification System (ASTM D 2487); however, visual classifications may be given on the logs.
- d. The foundation bearing capacity and settlement analyses were based on our current foundation design procedures, using the Standard Penetration N-values obtained during drilling and the results of the laboratory testing program.
- e. The flexible and rigid pavement sections discussed in this report are based on the design method utilizing estimated California Bearing Ratio (CBR) data derived from field/laboratory investigations and generally accepted industry standards.

AUTHORITY

This geotechnical investigation was authorized by Mr. Matt Silas, AIA, of Matt Silas, Architect, the architect and owner's representative for the proposed project. The scope of services and fees for this investigation were outlined in AECI Proposal No. 20316, signed on December 7, 2020.

PROJECT DESCRIPTION

The site of the proposed project is on the south side of Camp Road, approximately a quarter mile east of its intersection with Country Club Road in Pocahontas, Arkansas, as illustrated on the Vicinity Map, Plate 1. The site was vacant at the time of the field investigation and covered with sparse grass. The site slopes down to the south and east from near ± 427.0 msl at the northwest corner to ± 419.0 msl at the southeast corner. A preliminary finished floor elevation of 426.5 msl is planned, and will require ± 2.0 to ± 5.5 feet of fill within the building pad. Loads are anticipated to be light.

REGIONAL GEOLOGY

The 1993 Geologic Map of Arkansas, as prepared by the Arkansas Geologic Commission and the United States Geological Survey, indicates that the project is located within the Mississippi Embayment Physiographic Region of northeastern Arkansas and consists of terraced sediments deposited by the ancient Mississippi River and its tributaries during Quaternary times. These deposits generally consist of a complicated sequence of unconsolidated layers of gravels, sands, silts, and clays. The area is near the border of the Cotter/Jefferson City Dolomite Formation, which typically consists of shales, sandstones, and dolomites. The site soils were found to be consistent with the area geology.

FIELD INVESTIGATION

On December 16, 2020, a geotechnical drill crew visited the site and performed the drilling and sampling of five borings within the proposed construction area. The borings were placed across the site as illustrated on the Plan of Borings, Plate 2. Standard Penetration tests (SPT) were performed at selected intervals to determine the consistency of the subgrade soils. This testing consists of driving a split spoon sampler a total of 18.0 inches and recording the number of blows required to complete each 6.0-inch increment. The number of blows required to drive the last two intervals are summed to determine the N-value. A value greater than 50 blows per foot is considered refusal.

The boring logs illustrating stratigraphic and field test data are provided on Plates 3 through 7. The field classification system for soil and rock exploration and keys to soil classification and symbols are provided on Plates 8 through 11 with the Unified Soil Classification System provided on Plate 12. The N-values obtained from the borings are summarized on the following page. Auger refusal on probable dolomite was encountered between 14.0 and 15.0 feet in the deeper borings.

TABLE I
SUMMARY OF N-VALUES

DEPTH, feet	BORING NUMBERS				
	B1	B2	P1	P2	P3
0 - 1.5	8	9	9	6	7
2.5 - 4.0	14	15	11	13	19
5.0 - 6.5	11	22	13	13	22
7.5 - 9.0	13	19	--	--	--
10.0 - 11.5	48	22	--	--	--
15.0 - 16.5	--	50+	--	--	--

GROUNDWATER CONDITIONS

Groundwater was not encountered during the investigation. The water level, though, is seasonal in nature and will rise and fall with fluctuations in rainfall. Perched water can, however, be expected in the near surface soils, especially above the less permeable soils, especially during wet seasons. This latent water condition is typically due to storage of recent rainfall or by a barrier to capillary evaporation. Perched water, if encountered, will most likely be brief in duration and typically in low quantities. Areas likely to contain perched water include old drainage swales, around existing foundations/slabs, existing utility trenches, in fill areas, and beneath existing trees.

Where perched water is encountered the contractor should expect to excavate gravity drainage ditches to divert it away from the construction area. Additionally, soft, wet and pumpable soils can be expected during wet or winter weather. In structural areas these soils should be removed and be replaced with a select fill soil compacted to project specifications. Since the quantity of undercut is unknown it would be prudent to establish a unit rate for this item of work to minimize construction delays.

SITE DRAINAGE

The designer should also consider the topography of the site and surrounding areas during planning, design, and construction. The final grading should ensure positive drainage away from the building. It is strongly recommended that roof drains, condensate lines, and other potential water sources divert water away from the structure, preferably to a storm sewer system, to prevent accumulation around its perimeter. The subgrade soils have the ability of absorbing significant amounts of moisture, which could be detrimental as strength loss in foundation bearing soils.

Consideration should be given to control of surface water runoff during construction. The construction area gently slopes down to the south and east. The proposed construction areas should be maintained in a well drained condition to prevent water from ponding within the construction areas. Saturation of the subgrade soils could require additional amounts of undercut, especially during wet/winter months.

SEISMICITY

The seismic analysis requires the selection of appropriate site coefficients and other seismic values that can be established from the subsurface conditions, guidelines set forth by local, state, and federal codes, and historical seismic information. The structure should be designed using guidelines as set forth in the 2015 International Building Code as required by **Arkansas Act 1100-1991** (and subsequent amendments) as determined appropriate. The site soils consist primarily of clay (CL) over the depths investigated underlain by dolomite. The following seismic values were obtained from the U.S. Geological Seismic Design Maps application and are considered applicable to this project site based upon the site conditions and the 2015 International Building Code (IBC) seismic values for Arkansas:

IBC (2015)

Site Class	C*
Value of Site Coefficient (F_a)	1.091
Value of Site Coefficient (F_v)	1.526
Spectral Response Acceleration at Short Periods (S_s)	0.773 g
Spectral Response Acceleration at a Period of 1.0 Second (S_1) ..	0.274 g
Peak Ground Acceleration	0.428 g

*Considering the size and function of the proposed structure the 100-foot deep boring was not performed at the site as allowed by the IBC.

LABORATORY TESTING

Samples obtained from the borings were returned to the laboratory for further evaluation and laboratory testing. The moisture content of selected samples was determined and resulted in moisture contents ranging from 15.5% to 19.5%, which is likely near or slightly above optimum moisture content. Atterberg limit tests performed indicate most soils are slightly plastic with liquid limits ranging from 24 to 32 and plasticity index (PI) values between 8 and 16. These values increased in isolated areas, mostly in the deeper soils, though one sample near the surface was found to have a liquid limit of 46 and PI of 30. This area of the site could be fill from another site.

Mechanical grain size analyses were also performed and determined most soils contained between 61.4% and 77.9% fines (passing the No. 200 sieve). Based on these results, in addition to the Atterberg limit tests, most soils would best classify as sandy clay (CL). A representative sample was remolded in the laboratory and inundated to simulate the soils becoming saturated in the field. A negligible swell pressure resulted. In any case, a potential vertical rise (PVR) value of 0.50 inch should be considered in design to account for isolated higher plasticity soils. The individual test results are provided in Appendix B.

EARTHWORK

The following sections are intended to provide the designer and contractor with guidelines for construction of the project. They are not intended to be used as a specification for construction procedures or methods. It is strongly recommended that any desired modification be reviewed by the soils engineer prior to implementation into the project specifications. Site conditions different from those indicated herein may result in alteration of these recommendations, but should be verified by the soils engineer, or his representative.

Pre-Construction Considerations:

The condition of the subgrade materials should be considered a significant factor in the early stages of project planning and construction. The conditions reflected herein are based on the data obtained from the borings and the soil conditions at the time of drilling. Data obtained from the borings can be effected by seasonal fluctuations in rainfall and temperatures. Construction planning and sequencing will likely be a crucial factor on the amount of undercut required for soft soil conditions. Scarification, aeration, 'wind-rows' and other methods to stabilize soils in-place should be explored prior to making the determination of undercut.

Though efforts have been made to outline climatic factors and their potential impact on construction, other factors also will have a significant impact. Time constraints (proposed schedule) may restrict the contractor's ability to process wet soils. The means and methods of the contractor are not necessarily considered in the recommendations contained herein. The recommendations for site preparation are intended for a normal construction sequence. Prepared subgrade or compacted fill should not be subjected to prolonged periods of weather or construction traffic. Areas intended to be used as staging by the contractor will likely require additional processing and compaction due to distress caused by construction traffic.

It is highly recommended that the geotechnical engineer be included in pre-construction meetings. It would be prudent to perform a limited investigation (probing or test pits) to verify the soil conditions immediately prior to site work and determine if the recommendations contained herein warrant modification.

Site Preparation:

Vegetation and any topsoil should also be removed within the proposed construction areas. A stripping depth on the order of 6.0 to 10.0 inches should be anticipated for any areas of vegetation. Deeper stripping depths may be required in low lying areas. The organic and vegetative material may not be used for any part of the structural fill. However, it may be stockpiled on site and used as non-structural fill to improve seeding conditions in green areas. The exposed subgrade should be proof rolled with a loaded, tandem axle dump truck to identify soft, unstable soils. Several passes should be performed and observed by the soils engineer or his representative. A minimum of two complete passes, defined by forward and backward movement over a specific area, should be performed in perpendicular directions. Yielding soils should be removed or stabilized prior to fill placement. After proof rolling, the top 8.0 inches of natural ground should be scarified, moisture conditioned to at least optimum moisture content, and compacted to at least 95% ASTM D 698 prior to fill placement.

Data obtained from the borings indicate the condition of the shallow soils is marginal. Previous experience indicates soils with an N-value below 10 do not perform adequately for proof rolling operations outlined above. Referring to Table I on page 3 and the boring logs will provide some estimation of soft soils. Data obtained indicate soft soils should be expected in the upper 2.0 feet across the site and could require undercut. Some minor reworking of these materials could prove effective in stabilization. Scarification, wind-rows, and drying of materials prior to re-compaction should be explored. The effectiveness of stabilization through processing will be highly dependent on time constraints and weather conditions. During wet periods of the year or for a 'fast-track' construction schedule, undercut of soft soils could be required. Provided the subgrade is prepared sufficiently to pass a proof roll, the placement of fill could begin. Mechanical or chemical stabilization would also be an option in lieu of undercut.

Fill Placement:

Select fill should be granular, non-expansive type soils having a PI between 5 and 20 that are stable after placement. Locally available clay gravel (GC) or clay sand (SC) are acceptable materials. Other locally available materials may also be used if approved by the engineer. Fill should be placed in 8.0-inch thick loose lifts, moisture conditioned to within three points of optimum, and compacted to 98% of Standard compaction as per ASTM D 698. At no time should the particle size of the material exceed half the lift thickness.

The compaction and moisture content of fill materials should be verified through field density tests per ASTM D 6938. One test per lift should be performed for every 2500 square feet of building area, but could be increased to 5000 to 10,000 square feet for any parking or drive areas. It would be prudent to require in the specifications the performance of Atterberg limits and grain size analyses of fill materials during placement to ensure compliance with the criteria outlined herein as borrow pit soils may vary significantly across the pit.

Excavation Criteria:

A majority of the soils encountered at the site should be excavated with normal tracked excavators. Trench excavations for utilities should be completed with normal excavation equipment in most areas. The soils should not be prone to significant sloughing or cave-ins, unless they are allowed to saturate. Based on OSHA regulations (29 CFR 1926, Subpart P) regarding soil classification for trench excavations, the shallow soils encountered (<4.0 feet) would best classify as Type C. In any case, OSHA regulations regarding shoring or benching of excavations should be considered during construction. Backfilling trench excavations should satisfy the criteria given previously, though AHTD approved flowable fill may be used as an alternative for confined spaces provided it is allowed to properly cure.

Landscaping/Hardscaping:

The preferred landscaping method is to utilize green areas having a root barrier and a drainage system tied into the storm sewer system. Drip irrigation is preferred so that the amount of water can be controlled and routed away from the building ensuring that saturation of the foundation soils will not occur. As a general rule, the drip line of any existing or future full grown tree should not fall within the building area. Moisture control will also be added by having sidewalks, paving, properly drained green areas, or sloping ground surfaces for at least 5.0 feet outside the structure.

The green areas, sidewalks or paving must have positive slope away from the building and all joints must be sealed to prevent water infiltration. Implementation of these points will reduce the fluctuations in moisture content of the plastic soils and consequent movements of the foundation and floor slabs. It would also be prudent to capture roof drain outlets and AC unit condensate drip lines in the project storm sewer system. By doing so, the likelihood of distress from moisture variations to buildings, landscapes, and pavements is greatly decreased.

Adverse Weather Conditions:

Site grading and earthwork operations will be more difficult in wet or winter months. Should earthwork operations for the project begin in the time period of November through April, the owner should anticipate and budget for additional expenses for earthwork. Not only will more frequent and saturating rains be prevalent during these months, ambient air conditions are not conducive to drying of site soils. Efficient aeration and drying of soils is dependant upon high temperatures, low humidity, and the contractor's ability to disc or scarify the soils. Aeration and drying of on site soils will require additional effort by the contractor and should be considered during budgeting or planning.

Should the owner or contractor elect to begin earthwork in wet or winter months, undercut of soft soils will likely be the most feasible option. Mechanical stabilization of the on site soils is possible and could include the use of a geotextile fabric/grid to bridge over soft soils and provide support to subsequent fill. Implementation of a geotextile can be addressed once the grading plan for the project is near completion. Chemical stabilization through lime or fly ash worked into wet soils can also be effective. However, these methods are highly dependant upon the contractor's expertise, equipment, and proper installation or mixing methods. In any case, the proposed construction area should be maintained in a well drained condition during construction. Water should not be allowed to stand or pond on areas of exposed earthwork. In anticipation of rainfall, it would be prudent for the contractor to "seal" exposed subgrades with a smooth drum roller to promote runoff.

FOUNDATIONS

Conventional shallow foundations (strip/spread) are considered the most feasible foundation option for the proposed additions based on the anticipated loadings, site conditions, and earthwork criteria established in the previous section. The following discussion will provide bearing capacity, settlement, and other criteria typically required for in design. For the purposes of this report, bearing capacity refers to the net allowable bearing capacity, which is defined by the ultimate bearing capacity (factored dead and live loads) reduced by an acceptable factor of safety, which for this project is considered to be 2.0. Additionally, shape, inclination, groundwater depth, and other design factors are considered minimal and no reduction in bearing capacity are necessary for these conditions.

Bearing Capacity:

Based on the results of our field investigation a bearing capacity of 2000 psf should be applicable for foundations bearing at a depth of 2.0 feet below the existing grade on adequate natural ground or properly compacted select fill. Isolated areas of undercut could be required to obtain the recommended bearing capacity. These values were developed using SPT values obtained from the drilling and laboratory testing program utilizing our in-house design program. Increasing the allowable bearing capacity is possible, but could also increase the amount of undercut required. Should the designer desire to vary the bearing depths or capacities, this firm should be consulted for additional recommendations. It should be noted that the provided bearing capacity is applicable only if all criteria in the **EARTHWORK** section is met or exceeded. Interior footing depths may be decreased, so long as they satisfy local building codes, including a local frost depth of 12.0 inches but should still bear on natural ground that has passed proof rolling or properly compacted select fill.

Settlement:

The settlement of the foundations must be within tolerable limits, which should be established by the structural engineer, but have not been provided prior to this investigation. The potential settlement for conventional footings was estimated from results of Standard Penetration tests performed during drilling. The magnitude of total settlement for conventional footings at the recommended bearing capacities and depths were estimated to be on the order of 1.00 inch. A differential settlement of 0.50 inch is recommended for use in the structural design. Should the bearing capacity or loads used in design differ from those indicated herein, the amount of settlement will vary accordingly.

Other Design Considerations:

The bearing capacity and settlement discussions provided previously assume that the structural loadings are positioned such that a relatively uniform bearing pressure is exerted to the bearing strata. Eccentric, inclined or other loadings that result in a non-uniform bearing pressure will require further evaluation by this firm once specific loading conditions are established. In any case, it would be prudent to increase the rigidity of the foundation in an effort to minimize potential differential movements. An increase in rigidity can be achieved by techniques that would increase the section modulus of the foundation members. Column and wall footings should be designed in accordance with the requirements of the various applicable codes.

Resisting uplift loads should consider the weight of the footing and overlying soil backfill. A minimum factor of safety of 1.5 is recommended when calculating uplift resistance. For resistance of lateral forces, a net allowable passive resistance of 250 psf can be used for the portion of the footing extending below 1.5 feet. A coefficient of sliding resistance of 0.40 may be used by the designer to calculate frictional resistance along the bottom surface of the footing.

Excavation/Monitoring:

The excavations for footings should be performed with equipment capable of providing a clean bearing surface. It would be ideal for the bottom 6.0 inches of the excavation be achieved with a smooth plate excavator, or hand labor. Reinforcing steel and concrete should be placed as soon as possible upon completion of the geotechnical representative evaluation, as described below. All debris, standing water and mud, including saturated soils, should be removed. In no instance should concrete be placed in frozen or saturated soils. If unforeseen circumstances require excavations to remain open for an extended period, a thin “mud slab” may be placed in an effort to reduce disturbance to the bearing strata. In this case, the excavation should extend a minimum of 2.0 inches below planned depth, allowing a thin layer of concrete the same strength as required for the footings to be placed.

The performance of the foundation system will partially depend on the quality of construction. It would be prudent to have further evaluations by the soils engineer, or his representative, to verify that the design bearing value has been achieved in footing excavations. Furthermore, the condition of the subgrade should be evaluated to insure cleanliness and uniformity of bearing strata immediately prior to concrete placement. Bearing capacity can be verified by the use of a static cone penetrometer, or other acceptable means designated by the soils engineer.

FLOOR SLABS

Differential movement of the floor slab may be caused by a difference in the allowable gross bearing capacity, differing heave conditions, and/or variable thicknesses of compressible soils below the floors. The stiffness effect of a well compacted subgrade and/or engineered fill in conjunction with a granular base, collectively known as the soil support system, should greatly diminish the differential floor slab movements to tolerable limits. Based on the anticipated grades it appears that the soil support system will consist of compacted select fill and/or moisture conditioned compacted natural ground overlain by a free-draining granular fill. For this condition the designer should consider a modulus of subgrade reaction (k) of 100.0 pci over the top 8.0 inches of subgrade. The floor slabs and soil support system should be designed and constructed in accordance with American Concrete Institute (ACI) Publications 302.1R-15, Guide for Concrete Floor and Slab Construction, and 360R-10, Guide to Design of Slabs-on-Ground, and other applicable codes.

Subgrade Preparation:

Initially, the recommendations in the **EARTHWORK** section, including proof rolling and moisture/compaction testing, should be followed to prepare the subgrade. However, the designer should specify that after destructive/intrusive construction activities, such as weathering, construction traffic, and utility placement, the contractor be required to restore the top 8.0 inches of subgrade to its

specified moisture, density, and grade control immediately prior to slab placement. This rehabilitation should be verified through quality control testing and a rod and level survey, as directed by ACI 302.1R-15, Subsection 6.1. This will aid in prevention of post construction slab movements induced by moisture variations inherent to any soil type, especially for exposed or polished floors with no covering.

Granular Base:

As per ACI 302.1R-15, Subsection 6.1.4, the granular base should consist of a clean, densely graded granular material with a balanced fine content that produces a low-friction surface while minimizing wicking. This material should have 100% passing the 1½ inch (38 mm) sieve, 15% to 50% passing the No. 4 (4.75 mm) sieve, and less than 12% passing the No. 200 (75 µm) sieve or satisfy the requirements of ASTM D1241 with the modification allowance of less than 12% passing the No. 200 (75 µm) sieve. Additionally, the material passing the No. 200 (75 µm) sieve should be clean granular fill with less than 3% clay or friable particles. It should be noted, the ACI code states that clean/cushion/concrete sand “meeting ASTM C33/C33M, will not be adequate”. The base material should be placed and compacted with adequate quality control testing and grade control that conforms to ACI 117 with verification by rod and level survey.

Vapor Membrane:

The need for a vapor membrane depends on whether the floor slab will have a vapor sensitive covering, will have vapor sensitive items stored on the slab, or if the space above the slab will be a humidity controlled area. If the project does not have this vapor sensitivity or moisture control need, placement of a vapor membrane may not be necessary. However, if any of the above sensitivity issues apply, placement of a minimum 10-mil vapor membrane is recommended. Some floor covering systems (adhesives and flooring materials) may require a vapor membrane to maintain a specified maximum slab moisture content as a condition of their warranty. The architect/engineer should decide on a case-by-case basis whether to place the vapor membrane above or below the granular layer. The guidelines in ACI 302.1R-15, Subsection 6.1.5, and ACI 302.2R-06, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials, should be considered when determining the location of vapor membranes and the relation to floor finishes, project conditions, schedule, and the potential effects of slab curling and cracking.

DRIVES AND PARKING AREAS

The following pavement designs and pavement recommendations are based on numerous reasonable assumptions concerning the pavement use, site conditions, and maintenance. A minimum of 8.0 inches of properly compacted subgrade is recommended beneath the pavement section. An

estimated CBR of 3 was used for the subgrade soils and should be applicable provided criteria in the **EARTHWORK** section is met or exceeded. The base material and surface material thicknesses and construction procedures are provided in the following sections.

Flexible Pavement:

Flexible pavement typically consists of asphalt cement hot mix (ACHM) as specified by Section 407 of the Standard Specifications for Highway Construction (Edition of 2003) as published by the Arkansas State Highway and Transportation Department. The design requirements for ACHM surface course; 12.5 mm (Type II) and 9.5 mm (Type III) are provided in Tables 407-1 and 407-2, respectively. ACHM is most commonly used for light to moderate traffic areas including straight drives and parking areas for light vehicles. It should not be used in traffic lanes where trucks turn and backup or where trash dumpsters are located. Based on the subgrade CBR of 3 and a minimum of 8.0 inches of compacted subgrade the following sections will apply for light and heavy duty sections. The recommended pavement structures are shown on Plate 13.

<u>LIGHT</u>		<u>HEAVY</u>	
<u>Material</u>	<u>Thickness (inches)</u>	<u>Material</u>	<u>Thickness (inches)</u>
12.5 mm ACHM	2.0	12.5 mm ACHM	3.0
Class 7 Base	6.0	Class 7 Base	8.0

NOTES:

- 1) Compaction of ACHM should not be less than 92% of theoretical design mix.
- 2) Base material compaction should not be less than 100% ASTM D 698.
- 3) Class 5 may be substituted for Class 7 provided the thickness is increased by 2.0 inches.

Rigid Pavement Non-Reinforced:

Rigid pavements or Portland Cement Concrete (PCC) pavements consists of concrete materials and construction procedures as specified by Section 501 of the Standard Specifications for Highway Construction (Edition of 2003) as published by the Arkansas State Highway and Transportation Department. The material type and design requirements including admixtures, reinforcing, dowels, jointing, curing, and finish are provided therein. Rigid (PCC) pavements are commonly used for both light and heavy duty traffic applications. Minimally, approach slabs, truck turning areas, docks, and dumpster pads should be PCC. Based on the site subgrade CBR of 3 and a modulus of subgrade reaction of 100.0 pci over a minimum of 8.0 inches of compacted subgrade, the following sections will apply for both light and heavy duty pavement sections. The recommended pavement structures are shown on Plate 13.

<u>LIGHT</u>		<u>HEAVY</u>	
<u>Material</u>	<u>Thickness (inches)</u>	<u>Material</u>	<u>Thickness (inches)</u>
PCC	5.0	PCC	7.0
Class 7 Base	4.0	Class 7 Base	6.0

NOTES:

- 1) PCC strength to be 4000 psi at 28 days.
- 2) PCC to be entrained with 5% air.
- 3) Load transfer, dowels, and joints per ACI, AHTD or PCA guidelines.
- 4) Class 5 may be substituted for Class 7 provided the thickness is increased by 2.0 inches.

Pavement Performance/Maintenance:

The long term pavement performance will be directly related to several factors such as adequate edge drainage and surface drainage which does not allow water to accumulate on the pavement surface or behind the curbs and pavement edges. All pavement joints must be sealed and should be placed parallel to the overall site drainage direction. All irrigation, water, and other utility lines should be carefully monitored to insure they do not contribute to premature pavement failure by allowing water to migrate onto or under the pavements. Adequate quality control testing including proof rolling, compaction testing, thickness testing of base and ACHM as well as compaction of the ACHM is critical to successful long term pavement performance. In addition, pavements will require regular maintenance such as periodic surface sealing and crack sealing to prolong the desired performance and life.

QUALITY CONTROL

Quality control testing should be utilized in all phases of the construction. To verify that the proper performance of the proposed structures, all fill required should be compacted to a minimum of 98% Standard compaction, in accordance with ASTM D 698. The foundation excavations should be evaluated to verify that the recommended bearing capacity has not been reduced by disturbance to excavation or massive imperfections in the bearing strata. A geotechnical engineering representative should be present to evaluate the bottom of the foundation excavations prior to placement of concrete. Our recommendations are based upon adequate quality control testing being utilized and further evaluations and reviews during the construction phase of the project.

CONCLUSIONS AND RECOMMENDATIONS

As a result of this geotechnical investigation, the following recommendations are offered for consideration:

1. As previously discussed, conventional footings are suitable foundations for the proposed facility. It is recommended that the foundation be designed in accordance with the necessary structural and/or architectural requirements determined by the designers.
2. The allowable bearing capacity for conventional footing is 2000 psf at a depth of 2.0 feet below the existing grade on adequate natural ground or properly compacted fill.
3. Fill shall be placed in 8.0-inch thick lifts and be compacted within three percentage points of optimum moisture content to 98% Standard Proctor density as per ASTM D 698. The select fill shall be non-expansive, granular type soils with a PI between 5 and 20.
4. As an additional measure perimeter surface drainage and should be assured around the exterior of the building to intercept and drain surface runoff water from the near surface and foundation supporting soils. It would also be a prudent measure to slope backfill soils away from foundation walls.
5. The use of flexible or rigid pavements should be a function of the anticipated traffic use as determined by the designer using the recommended sections provided on pages 11 through 13 of this report. As a minimum PCC pavements should be used for truck/bus lanes and dumpster pads.
6. Quality control testing should be utilized in the construction of the foundation, undercutting, fill placement, and floor slab construction with adequate testing to verify that the design requirements have been achieved.
7. Geotechnical engineering services by a qualified firm are recommended during the foundation construction phase so that adequate compensation can be made for conditions that may occur which differ significantly from those assumed as a result of this investigation.
8. Other recommendations are given throughout the text of this report.

LIMITATIONS

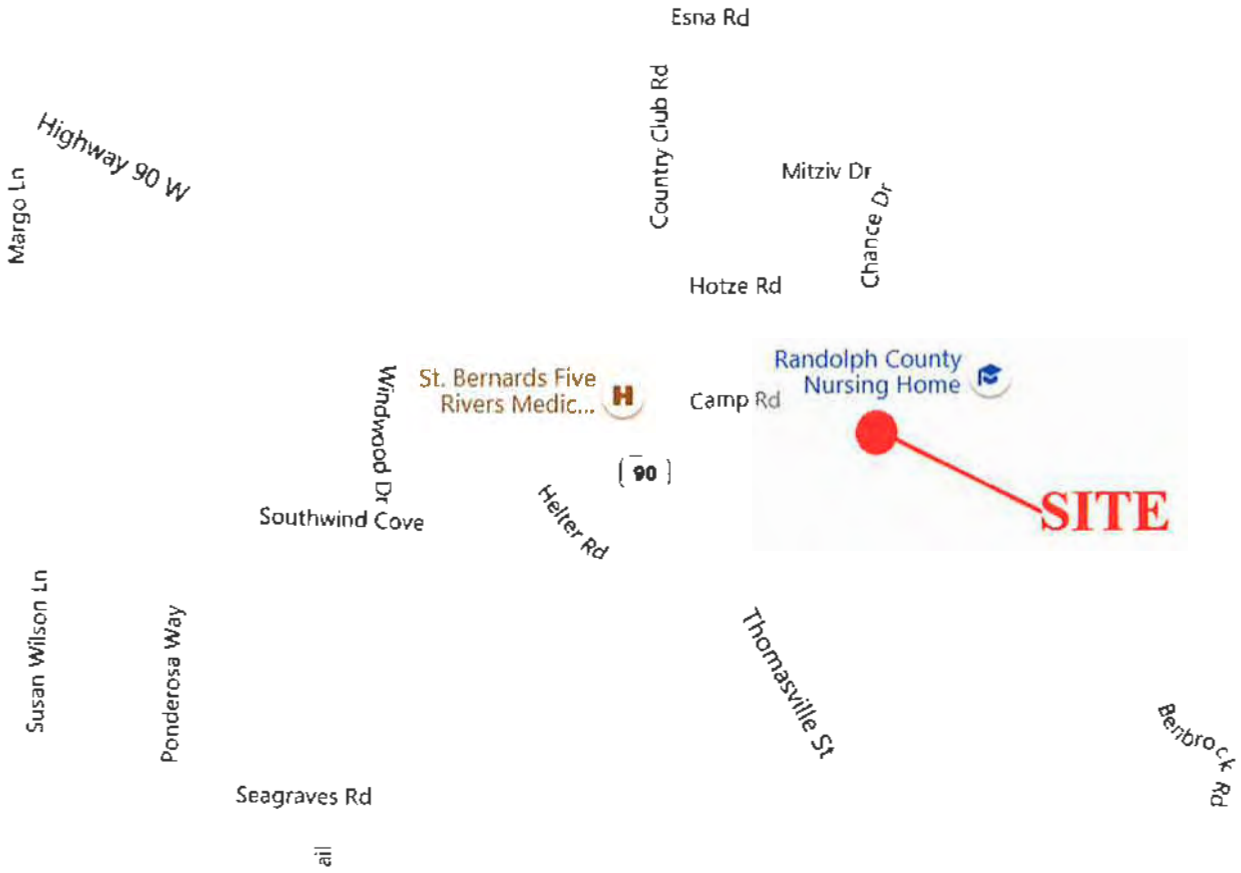
The boring logs shown in this report contain information related to the types of soil and rock encountered at specific locations and times and show lines delineating the interface between these materials, as well as results of tests performed in the laboratory on representative samples. The logs also contain our field technician's interpretation of conditions that are believed to exist in those depth intervals between the actual samples taken. Therefore, these boring logs contain both factual and interpretative information. It is not warranted that these logs are representative of subsurface conditions at other locations and times.

The analyses, conclusions, and recommendations contained in this report are based on site conditions as they existed at the time of our field investigation and further on the assumption that the exploratory borings are representative of the subsurface conditions throughout the site. If, during construction, different subsurface conditions from those encountered in our borings are observed, or appear to be present beneath excavations, we must be advised promptly so that we can review these conditions and provide new recommendations as becomes necessary. Recognize that both natural and manmade events may have changed site conditions since issuance of this report and further review may result. If after submission of this report structural loads or finished grades are changed from those that were assumed, we urge that we be promptly informed, and retained to review our report to determine the applicability of the conclusions and recommendations, considering the changed conditions and/or time lapse. Further, we request that our firm be retained to review those portions of the plans and specifications for this particular project that pertain to earthwork and foundations as a means to determine whether the plans and specifications are consistent with the recommendations contained in the report.

It should be understood that there is the possibility that even with the proper application of current engineering principles, conditions may exist on the site that could not be identified within the scope of this investigation or which were not reasonably identifiable from the available information. The conclusions and recommendations in this report contain all the limitations inherent to the principles and practice of geotechnical engineering. AECI has not performed any observations, investigation, study, or testing that is not specifically listed in the scope of services. Thus, AECI shall not be liable for failing to discover any condition whose discovery required the performance of services outside of the scope of services provided in our proposal.

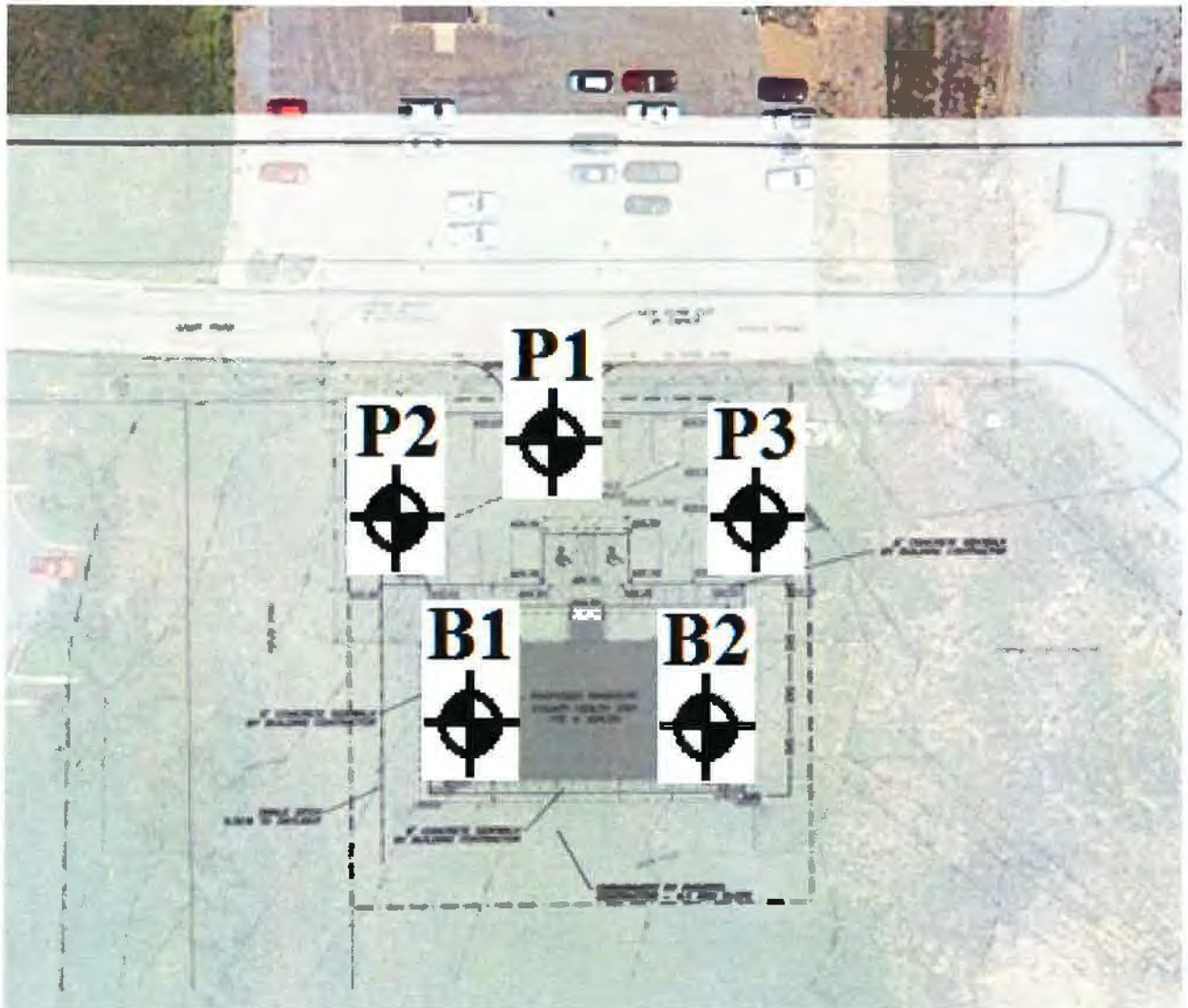
* * * * *

APPENDIX A
PLATES



VICINITY MAP
POCAHONTAS, ARKANSAS

NOT DRAWN TO SCALE.



PLAN OF BORINGS



AECI COPYRIGHT © 2020

LOG OF BORING

PROJECT: RANDOLPH COUNTY HEALTH UNIT
POCAHONTAS, ARKANSAS
FOR: MATT SILAS, ARCHITECT

BORING NO: B1

LOCATION: SEE PLAN OF BORINGS

DATE: 12/16/20

JOB NO: 16686

BORING TYPE: AUGER W/SPT

DRILLER: BRADBURY
SIMCO 2400

GEOTECHNICIAN: BRADBURY

GROUND ELEVATION: 423.5± msl

Depth In Feet	Sample Type & No	N-Blows Per Foot	Graphic Symbol	LEGEND		
				S Shelby Tube ■ Core ∇ Static Water Table	NV Diamond Core ⊠ Standard Penetration ∇ Hydrostatic Water Table	P Penetration Test □ J - Jar ⊠ No Recovery
VISUAL DESCRIPTION OF STRATUM						
0	P1	8		MEDIUM STIFF TO STIFF MOIST DARK BROWN SANDY CLAY (CL) PP = 1.00 KSF		
	P2	14		CONTINUES SANDY (CL) - BECOMES LIGHT GRAY PP = 1.50 KSF		
5	P3	11		CONTINUES SANDY (CL) - BECOMES REDDISH BROWN PP = 1.25 KSF		
	P4	13		CONTINUES SANDY (CL) PP = 1.50 KSF		
10	P5	48		DENSE MOIST BROWN CLAYEY SAND (SC) WITH GRAVEL		
				AUGER REFUSAL AT 14.0 FEET ON PROBABLE DOLOMITE		
15				BOTTOM OF HOLE AT 14.0 FEET. BORING REMAINED OPEN. NO WATER ENCOUNTERED IN THIS BORING. APPROXIMATELY 3.0 FEET OF FILL ANTICIPATED AT THIS LOCATION. FINISHED FLOOR ELEVATION = 426.5 MSL.		
20						
25						

LOG OF BORING

PROJECT: RANDOLPH COUNTY HEALTH UNIT
POCAHONTAS, ARKANSAS

BORING NO: B2

FOR: MATT SILAS, ARCHITECT

LOCATION: SEE PLAN OF BORINGS

DATE: 12/16/20 **JOB NO:** 16686

BORING TYPE: AUGER W/SPT

DRILLER: BRADBURY
SIMCO 2400

GEOTECHNICIAN: BRADBURY

GROUND ELEVATION: 421.0± msl

Depth In Feet	Sample Type & No	N-Blows Per Foot	Graphic Symbol	LEGEND		
				S Shelby Tube	NV Diamond Core	P Penetration Test
			█ Core	⊠ Standard Penetration	▢ J - Jar	
			∇ Static Water Table	∇ Hydrostatic Water Table	⊠ No Recovery	
VISUAL DESCRIPTION OF STRATUM						
0	P1	9		MEDIUM STIFF TO VERY STIFF MOIST BROWN SANDY CLAY (CL) PP = 1.00 KSF		
	P2	15		CONTINUES SANDY (CL) - BECOMES BROWN AND LIGHT GRAY PP = 1.50 KSF		
5	P3	22		CONTINUES SANDY (CL) PP = 2.25 KSF		
	P4	19		CONTINUES SANDY (CL) - BECOMES REDDISH BROWN PP = 2.00 KSF		
10	P5	22		CONTINUES SANDY (CL) PP = 2.25 KSF		
15	P6	50/0"		HARD WEATHERED WHITE DOLOMITE AUGER REFUSAL AT 15.0 FEET ON DOLOMITE		
				BOTTOM OF HOLE AT 15.0 FEET. BORING REMAINED OPEN. NO WATER ENCOUNTERED IN THIS BORING. APPROXIMATELY 5.5 FEET OF FILL ANTICIPATED AT THIS LOCATION. FINISHED FLOOR ELEVATION = 426.5 MSL.		
20						
25						

LOG OF BORING

PROJECT: RANDOLPH COUNTY HEALTH UNIT
POCAHONTAS, ARKANSAS

BORING NO: P1

FOR: MATT SILAS, ARCHITECT

LOCATION: SEE PLAN OF BORINGS

DATE: 12/16/20 **JOB NO:** 16686

BORING TYPE: AUGER W/SPT

DRILLER: BRADBURY
SIMCO 2400

GEOTECHNICIAN: BRADBURY

GROUND ELEVATION: 425.0± msl

Depth In Feet	Sample Type & No.	N-Blows Per Foot	Graphic Symbol	LEGEND		
				S Shelby Tube	NV Diamond Core	P Penetration Test
			█ Core	⊠ Standard Penetration	⏏ J - Jar	
			⚡ Static Water Table	⚡ Hydrostatic Water Table	⊠ No Recovery	
				VISUAL DESCRIPTION OF STRATUM		
0	P1	9		STIFF MOIST BROWN SANDY CLAY (CL) PP = 1.00 KSF		
	P2	11		CONTINUES SANDY (CL) - BECOMES BROWN AND LIGHT GRAY PP = 1.25 KSF		
5	P3	13		STIFF MOIST REDDISH BROWN FAT CLAY (CH) PP = 1.50 KSF		
				BOTTOM OF HOLE AT 6.5 FEET. BORING REMAINED OPEN. NO WATER ENCOUNTERED IN THIS BORING. APPROXIMATELY 1.0 FOOT OF FILL ANTICIPATED AT THIS LOCATION. FINISHED GRADE = 426.0 MSL.		
10						
15						
20						
25						

LOG OF BORING

PROJECT: RANDOLPH COUNTY HEALTH UNIT
POCAHONTAS, ARKANSAS

BORING NO: P2

FOR: MATT SILAS, ARCHITECT

LOCATION: SEE PLAN OF BORINGS

DATE: 12/16/20 **JOB NO:** 16686

BORING TYPE: AUGER W/SPT

DRILLER: BRADBURY **GEOTECHNICIAN:** BRADBURY

GROUND ELEVATION: 425.5± msl

Depth In Feet	Sample Type & No	N-Blows Per Foot	Graphic Symbol	LEGEND		
				S Shelby Tube	NV Diamond Core	P Penetration Test
				▣ Standard Penetration	▢ J - Jar	
				▽ Static Water Table	▽ Hydrostatic Water Table	▣ No Recovery
VISUAL DESCRIPTION OF STRATUM						
0				STIFF MOIST BROWN SANDY CLAY (CL) PP = 1.00 KSF		
	P1	6	▨			
				CONTINUES SANDY (CL) - BECOMES BROWN AND LIGHT GRAY PP = 1.25 KSF		
	P2	13	▨			
5				CONTINUES SANDY (CL) - BECOMES REDDISH BROWN PP = 1.25 KSF		
	P3	13	▨			
				BOTTOM OF HOLE AT 6.5 FEET. BORING REMAINED OPEN. NO WATER ENCOUNTERED IN THIS BORING. APPROXIMATELY 0.5 FOOT OF FILL ANTICIPATED AT THIS LOCATION. FINISHED GRADE = 426.0 MSL.		
10						
15						
20						
25						

LOG OF BORING

PROJECT: RANDOLPH COUNTY HEALTH UNIT
POCAHONTAS, ARKANSAS

BORING NO: P3

FOR: MATT SILAS, ARCHITECT

LOCATION: SEE PLAN OF BORINGS

DATE: 12/16/20 **JOB NO:** 16686

BORING TYPE: AUGER W/SPT

DRILLER: BRADBURY
SIMCO 2400 **GEOTECHNICIAN:** BRADBURY

GROUND ELEVATION: 422.0± msl

Depth In Feet	Sample Type & No	N-Blows Per Foot	Graphic Symbol	LEGEND		
				S Shelby Tube	NV Diamond Core	P Penetration Test
				▣ Core	⊠ Standard Penetration	⊞ J - Jar
				∇ Static Water Table	⤵ Hydrostatic Water Table	⊞ No Recovery
VISUAL DESCRIPTION OF STRATUM						
0	P1	7		MEDIUM STIFF MOIST LIGHT BROWN FAT CLAY (CH) PP = 0.75 KSF		
	P2	19		VERY STIFF MOIST REDDISH BROWN SANDY CLAY (CL) PP = 2.00 KSF		
5	P3	22		MEDIUM DENSE MOIST REDDISH BROWN CLAYEY SAND (SC) WITH GRAVEL		
				BOTTOM OF HOLE AT 6.5 FEET. BORING REMAINED OPEN. NO WATER ENCOUNTERED IN THIS BORING. APPROXIMATELY 4.0 FEET OF FILL ANTICIPATED AT THIS LOCATION. FINISHED GRADE = 426.0 MSL.		
10						
15						
20						
25						

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON COHESIVE SOILS

(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 0 to 4 blows/ft.
Loose	- 4 to 10 blows/ft.
Medium Dense	- 10 to 30 blows/ft.
Dense	- 30 to 50 blows/ft.
Very Dense	- over 50

Particle Size Identification

Boulders	- 8-inch diameter or more
Cobbles	- 3 to 8-inch diameter
Gravel	- Coarse - 1 to 3-inch
	Medium - ½ to 1-inch
	Fine - ¼ to ½-inch
Sand	- Coarse - 0.6 mm to ¼-inch (dia. of pencil lead)
	Medium - 0.2 mm to 0.6 mm (dia. of broom straw)
	Fine - 0.05 mm to 0.2 mm (dia. of human hair)
Silt	- 0.06 mm to 0.002 mm (Cannot see particles)

Relative Proportions

<u>Descriptive Term</u>	<u>Percent</u>
Trace	1 to 10
Little	11 to 20
Some	21 to 35
And	36 to 50

COHESIVE SOILS

(Clay, Silt and Combinations)

Consistency

Very Soft	- < 2 blows/ft.
Soft	- 2 to 4 blows/ft.
Medium Stiff	- 4 to 8 blows/ft.
Stiff	- 8 to 15 blows/ft.
Very Stiff	- 15 to 30 blows/ft.
Hard	- over 30

Plasticity

<u>Degree of Plasticity</u>	<u>Plasticity Index</u>
None to slight	0 to 4
Slight	5 to 7
Medium	8 to 22
High to Very High	over 22

NOTES

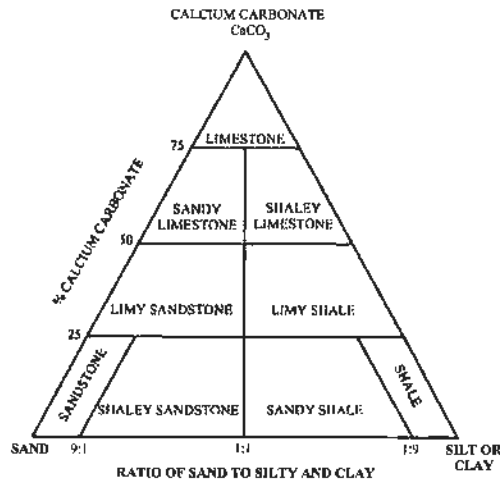
Classification - The classifications given on the logs are made by visual inspection.

Standard Penetration Test - Driving a 2.0-inch O.D., 1¾-inch I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140-pound hammer free falling a distance of 30.0 inches. It is customary for AECI to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6.0 inches of penetration on the drill log (Example: 6/8/9). The standard penetration test results can be obtained by adding the last two figures (i.e., 8 + 9 = 17 blows/ft.).

Strata Changes - In the column "Soil Descriptions" on the drill log the horizontal lines represent strata changes. A solid line (—) represents an actually observed change, a dashed line (- - -) represents an estimated change.

Groundwater - The groundwater observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

FIELD IDENTIFICATION SYSTEM FOR ROCKS



CLASSIFICATION
NAME

DESCRIPTION

- LIMESTONE** Light to dark colored, crystalline to fine-grained texture, composed of $CaCO_3$, reacts with HCl.
- DOLOMITE** Light to dark colored, crystalline to fine-grained texture, compacted of $MgCO_3$, slightly harder than limestone, reacts to HCl when powdered.
- CHERT** Light to dark colored, smooth very fine-grained texture, compacted of micro-crystalline quartz (SiO_2), brittle, breaks into angular fragments, will scratch glass.
- SHALE** Usually dark colored, very fine-grained texture, composed of consolidated mud, silt, or clay, usually bedded in thin layers. The unlaminated equivalent is frequently referred to as siltstone, daystone, or mudstone.
- SANDSTONE** Usually light colored, coarse to fine texture, composed of cemented sand size grains of quartz, feldspar, etc.

PHYSICAL PROPERTIES

BEDDING CHARACTERISTICS

THICKNESS	THICKNESS	
	Feet	cm
VERY THICK BEDDED	>3'	>100
THICK BEDDED	1' - 3'	30 - 100
MEDIUM BEDDED	4" - 1'	10 - 30
THIN BEDDED	1" - 4"	3 - 10
VERY THIN BEDDED	0.4" - 1"	1 - 3
LAMINATED	0.1" - 0.4"	0.3 - 1
THINLY LAMINATED	<0.1"	<0.3

HARDNESS AND DEGREE OF CEMENTATION

- LIMESTONE** **Hard** - Difficult to scratch with knife.
Moderately Hard - Can be scratched easily with knife, cannot be scratched with fingernail.
Soft - Can be scratched with fingernail.
- SHALE** **Hard** - Can be scratched easily with knife, cannot be scratched with fingernail.
Moderately Hard - Can be scratched with fingernail.
Soft - Can be easily molded with fingers.
- SANDSTONE** **Well Cemented** - Capable of scratching a knife blade.
Cemented - Can be scratched with knife.
Poorly Cemented - Can be broken apart easily with fingers.

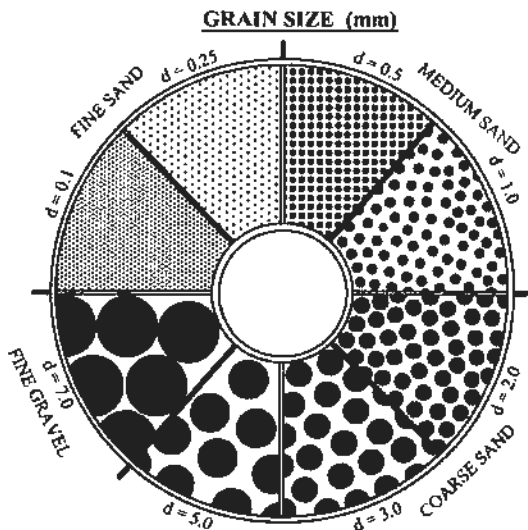
- BEDDING PLANES** Planes dividing sedimentary rocks of the same or different lithology.
- JOINT** Fracture in rock, generally more or less vertical or transverse to the bedding.
- SEAM** Generally applies to bedding plane with an unspecified degree of weathering.

DEGREE OF WEATHERING

- SLIGHTLY WEATHERED** Slight decomposition of parent material in joints and seams.
- WEATHERED** Well developed and decomposed joints and seams.
- HIGHLY WEATHERED** Rock highly decomposed, may be extremely broken.

SOLUTION AND VOID CONDITIONS

- SOLID** Contains no voids.
- VUGGY (PITTED)** Rock having small solution pits or cavities up to 1/2 inch diameter, frequently with a mineral lining.
- POROUS** Containing numerous voids, pores, or other openings, which may or may not interconnect.
- CAVERNOUS** Containing cavities or caverns, sometimes quite large.



KEY TO SOIL CLASSIFICATIONS AND SYMBOLS

UNIFIED SOIL CLASSIFICATION SYSTEM ⁽¹⁾				TERMS CHARACTERIZING SOIL STRUCTURE ⁽²⁾
Major Divisions	Letter	Symbol		Name
		Hatching	Color	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW		Well-graded gravels or gravel-sand mixtures, little or no fines
		GP		Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM		Silty gravels, gravel-sand-silt mixtures
		GC		Clayey gravels, gravel-sand-clay mixtures
	SAND AND SANDY SOILS	SW		Well-graded sands or gravelly sands, little or no fines
		SP		Poorly-graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand-silt mixtures
		SC		Clayey sands, sand-clay mixtures
FINE GRAINED SOILS	SILTS AND CLAYS LL<50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL		Organic silts and organic silt-clays of low plasticity
	SILTS AND CLAYS LL>50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of high plasticity, fat clays
		OH		Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	Pt		Peat and other highly organic soils	

SLICKENSIDED - having inclined planes of weakness that are slick and glossy in appearance.

FISSURED - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.

LAMINATED (VARVED) - composed of thin layers of varying color and texture, usually grading from sand or silt at the bottom to clay at the top.

CRUMBLY - cohesive soils which break into small blocks or crumbs on drying.

CALCAREOUS - containing appreciable quantities of calcium carbonate, generally nodular.

WELL GRADED - having wide range in grain sizes and substantial amounts of all intermediate particle sizes.

POORLY GRADED - predominantly of one grain size (uniformly graded) or having a range of sizes with some intermediate size missing (gap or skip graded).

SYMBOLS FOR TEST DATA

M/C = 15 - Natural moisture content in percent.
 γ = 95 - Dry unit weight in pounds/cubic foot.
 Q_u = 1.23 - Unconfined compression strength in tons/square foot.
 Q_c = 1.68 (21 psi) - Confined compression strength at indicated lateral pressure.
 51-21-30 - Liquid limit, Plastic limit, and Plasticity index.
 30% FINER - Percent finer than No. 200 mesh sieve.
 30 B/F - Blows per foot, Standard Penetration test.
 ▼ - Hydrostatic water table.
 ▽ - Static water table.

TERMS DESCRIBING CONSISTENCY OF SOILS⁽²⁾

COARSE GRAINED SOILS		FINE GRAINED SOILS		
DESCRIPTIVE TERM	NO. BLOWS/FOOT STANDARD PEN. TEST	DESCRIPTIVE TERM	NO. BLOWS/FOOT STANDARD PEN. TEST	UNCONFINED COMPRESSION TONS PER SQ. FT.
Very Loose	0 - 4	Very Soft	<2	<0.25
Loose	4 - 10	Soft	2 - 4	0.25 - 0.50
Firm (medium dense)	10 - 30	Plastic (medium stiff)	4 - 8	0.50 - 1.00
Dense	30 - 50	Stiff	8 - 15	1.00 - 2.00
Very Dense	over 50	Very Stiff	15 - 30	2.00 - 4.00
		Hard	over 30	over 4.00

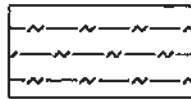
Field classification for "Consistency" is determined with a 0.25-inch diameter penetrometer.

(1) - From Waterways Experiment Station Technical Memorandum No. 3-357
 (2) - From "Soil Mechanics in Engineering Practice" by Terzaghi and Peck

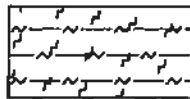
CONSOLIDATED GEOLOGIC FORMATIONS

GRAPHIC LOG SYMBOLS

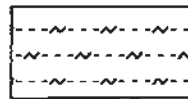
SEDIMENTARY ROCKS



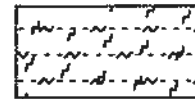
SHALE



SHALE
(weathered)



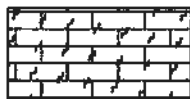
SANDSTONE



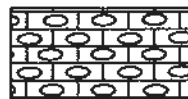
SANDSTONE
(weathered)



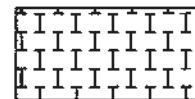
LIMESTONE



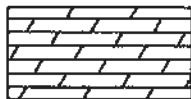
LIMESTONE
(weathered)



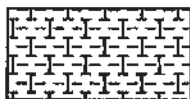
LIMESTONE
(cherty)



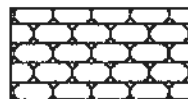
CHALK



DOLOMITE



MARL



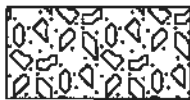
BEDDED CHERT



NOVACULITE



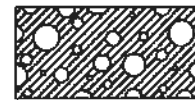
COAL/LIGNITE



BRECCIA



CONGLOMERATE

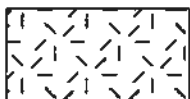


BAUXITE

METAMORPHIC ROCKS



SLATE



SCHIST



GNEISS



QUARTZITE

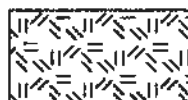
IGNEOUS ROCKS



NEPHELINE
SYENITE



TUFF



GRANITE



LAMPROITE

MODIFICATION OF THESE FORMATIONS CAN BE SHOWN BY A COMBINATION OF SYMBOLS

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

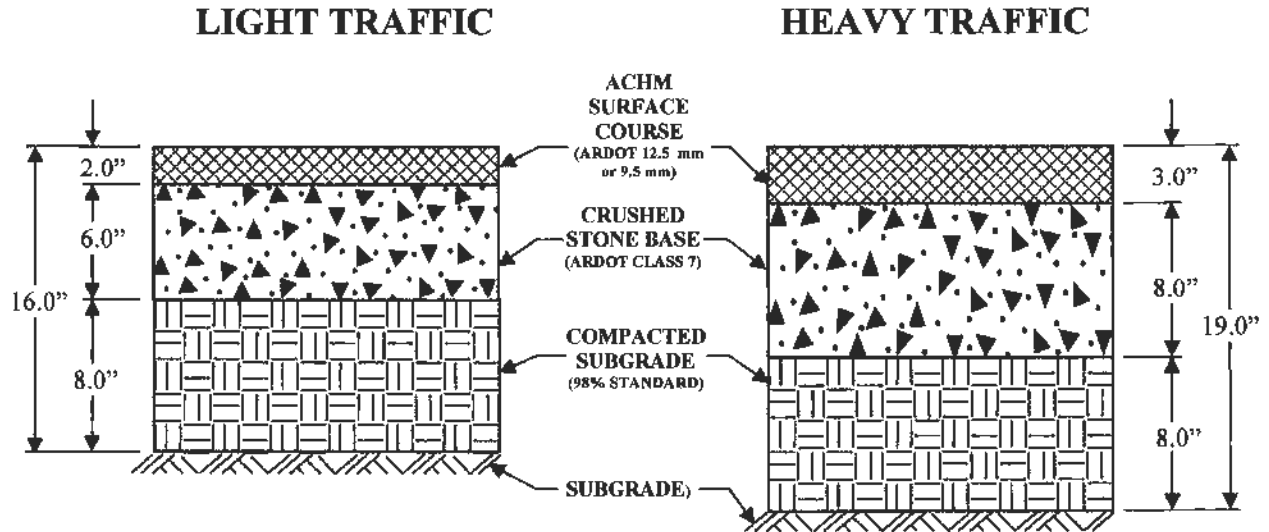
Major divisions		Group Symbols	Typical Names	Laboratory Classifications Criteria			
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (more than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4	$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines			Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM*	d	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. Between 4 and 7 are borderline cases requiring use of dual symbols
				u			
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7		
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4	$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3	
			SP	Poorly graded sands, gravelly sands, little or no fines			Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM*	d	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u			
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7		
Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity				
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays				
		OL	Organic silts and organic silty clays of low plasticity				
	Silts and clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	OH and MH			
		CH	Inorganic clays of high plasticity, fat clays				
		OH	Organic clays of medium to high plasticity, organic silts				
	Pt	Peat and other highly organic soils					

Determine percentages of sand and gravel from grain-size curve
 Depending on percentage of fines (fraction smaller than No. 200 sieve size),
 coarse-grained soils are classified as follows:
 Less than 5 percent fines GW, GP, SW, SP
 More than 5 percent and less than 12 percent fines GM, GC, SM, SC
 5 to 12 percent fines Borderline cases requiring dual symbols **

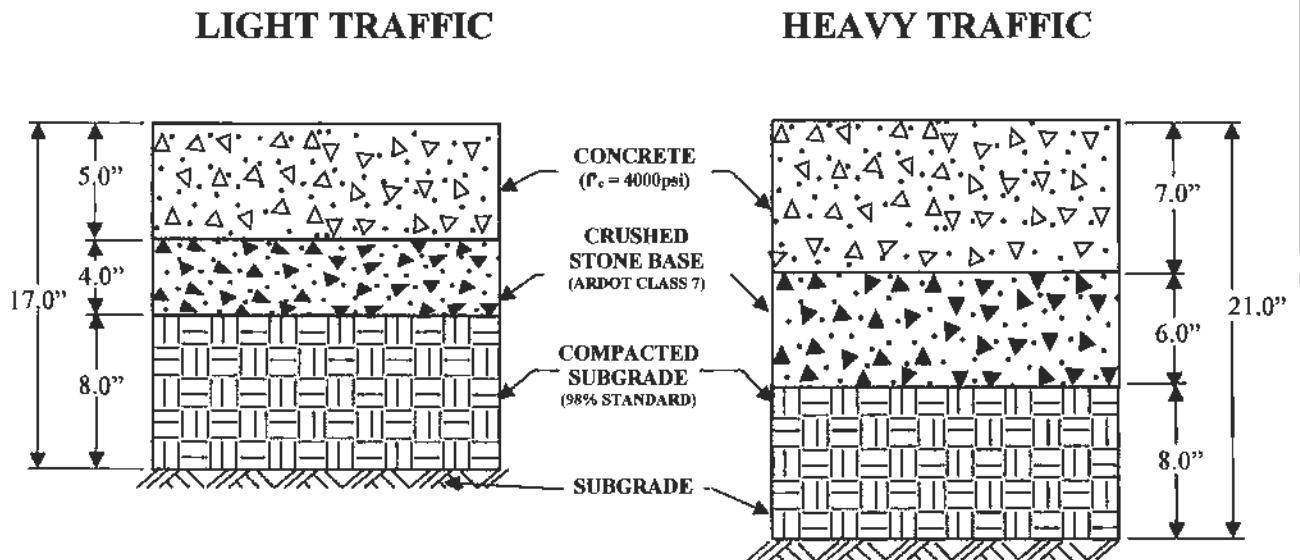
*Division of GM and SM groups into subdivisions of d and u are for roads and airfield only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; u used when L.L. is greater than 24.

**Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example GW-GC, well-graded gravel-sand mixture with clay binder.

RECOMMENDED FLEXIBLE PAVEMENT STRUCTURE



RECOMMENDED RIGID PAVEMENT STRUCTURE



APPENDIX B
SUPPORTING LABORATORY DATA

**MOISTURE CONTENT DETERMINATION
ASTM D 2216**

Project: RANDOLPH COUNTY HEALTH UNIT
Location: POCAHONTAS, ARKANSAS

Project No.: 16686
Date: 12/22/20

MOISTURE CONTENT

Sample Number	B1;P1	B1;P3	B1;P4	P1;P1	P1;P2
Tare Number	E140	F26	5	E20	VII
Tare + Wet Soil (g)	162.01	169.03	155.20	165.63	177.81
Tare + Dry Soil (g)	140.41	143.23	133.73	141.74	155.59
Tare (g)	11.05	11.00	12.57	11.24	11.94
Water (g)	21.60	25.80	21.47	23.89	22.22
Dry Soil (g)	129.36	132.23	121.16	130.50	143.65
Water Content (%)	16.70	19.51	17.72	18.31	15.47

**ATTERBERG LIMIT DETERMINATION
ASTM D 4318**

Project: RANDOLPH COUNTY HEALTH UNIT
Location: POCAHONTAS, ARKANSAS

Project No.: 16686
Date: 12/23/20

LIQUID LIMIT

Sample Number	B1;P2	B1;P4	B2;P1	P1;P1	P3;P1
Tare Number	74	LPD	60	155	23
Number of Blows	25	24	22	22	23
Tare + Wet Soil (g)	18.97	16.78	34.58	35.76	17.05
Tare + Dry Soil (g)	16.83	13.88	28.30	28.94	14.06
Tare (g)	8.01	6.92	7.60	8.17	7.62
Water (g)	2.14	2.90	6.28	6.82	2.99
Dry Soil (g)	8.82	6.96	20.70	20.77	6.44
Water Content (%)	24.26	41.67	30.34	32.84	46.43
Liquid Limit	24	41	30	32	46

PLASTIC LIMIT

Sample Number	B1;P2	B1;P4	B2;P1	P1;P1	P3;P1
Tare Number	772	63	71	81F	KH
Tare + Wet Soil (g)	18.70	18.51	19.94	17.27	16.35
Tare + Dry Soil (g)	17.25	17.17	18.51	15.86	15.04
Tare (g)	8.14	8.26	8.46	6.77	6.83
Water (g)	1.45	1.34	1.43	1.41	1.31
Dry Soil (g)	9.11	8.91	10.05	9.09	8.21
Water Content (%)	15.92	15.04	14.23	15.51	15.96
Plastic Limit	16	15	14	16	16
Plasticity Index	8	26	16	16	30
Classification (#40)	CL	CL	CL	CL	CL

**MECHANICAL GRAIN SIZE ANALYSES
ASTM D 1140**

Project:	RANDOLPH COUNTY HEALTH UNIT	Project No.:	16686
Location:	POCAHONTAS, ARKANSAS	Date:	12/23/20
Sample No.:	B1;P1	Sample Depth:	0'-1.5'
Soil Description:	GRAY & LIGHT REDDISH BROWN LEAN CLAY W/ SAND		

Sieve or Screen	Weight Retained (grams)	Cumulative Weight Retained (grams)	Percent Retained	Percent Passing
#200	126.1	126.1	28.4	71.6
PAN	317.3	443.4	100.0	0.0

Percent Sample Gravel/Sand:	28.4	Sample Weight:	443.4
Percent Sample Silt/Clay:	71.6	Washing Loss:	317.3g

Project:	RANDOLPH COUNTY HEALTH UNIT	Project No.:	16686
Location:	POCAHONTAS, ARKANSAS	Date:	12/23/20
Sample No.:	B1;P3	Sample Depth:	5'-6.5'
Soil Description:	REDDISH BROWN & LIGHT GRAY SANDY LEAN CLAY		

Sieve or Screen	Weight Retained (grams)	Cumulative Weight Retained (grams)	Percent Retained	Percent Passing
#200	204.6	204.6	38.6	61.4
PAN	325.1	529.7	100.0	0.0

Percent Sample Gravel/Sand:	38.6	Sample Weight:	529.7
Percent Sample Silt/Clay:	61.4	Washing Loss:	325.1g

**MECHANICAL GRAIN SIZE ANALYSES
ASTM D 1140**

Project:	RANDOLPH COUNTY HEALTH UNIT	Project No.:	16686
Location:	POCAHONTAS, ARKANSAS	Date:	12/23/20
Sample No.:	B1;P5	Sample Depth:	10'-11.5'
Soil Description:	REDDISH BROWN & LIGHT GRAY CLAYEY SAND W/ GRAVEL		

Sieve or Screen	Weight Retained (grams)	Cumulative Weight Retained (grams)	Percent Retained	Percent Passing
#200	246.3	246.3	71.8	28.2
PAN	96.7	343.0	100.0	0.0

Percent Sample Gravel/Sand:	71.8	Sample Weight:	343.0
Percent Sample Silt/Clay:	28.2	Washing Loss:	96.7g

Project:	RANDOLPH COUNTY HEALTH UNIT	Project No.:	16686
Location:	POCAHONTAS, ARKANSAS	Date:	12/23/20
Sample No.:	B2;P2	Sample Depth:	2.5'-4'
Soil Description:	LIGHT GRAY & LIGHT REDDISH BROWN LEAN CLAY W/ SAND		

Sieve or Screen	Weight Retained (grams)	Cumulative Weight Retained (grams)	Percent Retained	Percent Passing
#200	106.0	106.0	22.1	77.9
PAN	374.5	480.5	100.0	0.0

Percent Sample Gravel/Sand:	22.1	Sample Weight:	480.5
Percent Sample Silt/Clay:	77.9	Washing Loss:	374.5g

MECHANICAL GRAIN SIZE ANALYSES
ASTM D 1140

Project: RANDOLPH COUNTY HEALTH UNIT **Project No.:** 16686
Location: POCAHONTAS, ARKANSAS **Date:** 12/23/20
Sample No.: P1;P2 **Sample Depth:** 2.5'-4'
Soil Description: LIGHT REDDISH BROWN & LIGHT GRAY LEAN CLAY W/ SAND

Sieve or Screen	Weight Retained (grams)	Cumulative Weight Retained (grams)	Percent Retained	Percent Passing
#200	118.4	118.4	27.2	72.8
PAN	317.1	435.5	100.0	0.0

Percent Sample Gravel/Sand: 27.2 **Sample Weight:** 435.5
Percent Sample Silt/Clay: 72.8 **Washing Loss:** 317.1g

SHRINKAGE / SWELL INDEX TESTS

Project:	RANDOLPH COUNTY HEALTH UNIT	Project No.:	16686
Location:	POCAHONTAS, ARKANSAS	Date:	12/22/20
Sample No.:	B1;P2	Sample Depth:	2.5'-4'
Soil Description:	LT. GRAY & LT. REDDISH BROWN LEAN CLAY W/ SAND	K PRC:	2.0

Liquid Limit:	24	Est. Specific Gravity:	2.67
Plastic Limit:	16	No. of Layers:	3
Plasticity Index:	8	No. Blows/Layer:	7

WATER CONTENT

	Before Test		After Test
Tare Number	F	Tare Number	BC164
Tare + Wet Soil	182.6 g	Tare + Wet Soil	149.2 g
Tare + Dry Soil	157.8 g	Tare + Dry Soil	130.8 g
Tare	11.1 g	Tare	21.7 g
Water Content	16.8 %	Water Content	16.9 %
Saturation	100.0 %	Saturation	100.0 %
Dry Density	117.9 pcf	Dry Density	117.9 pcf

VOID RATIO DETERMINATION

Vo	57.786 ccm	Vf	57.786 ccm
Wt of Soil + Ring	360.7 g	Wt of Soil + Ring	360.8 g
Wt of Ring	233.1 g	Wt of Ring	233.1 g
Moist Wt of Soil	127.6 g	Moist Wt fo Soil	127.7 g
Vs	40.898 ccm	Vs	40.898 ccm
Eo	0.4129	Ef	0.4129

SWELL DATA

Time	Dial (* 0.0001)	Pressure	Void Ratio
9.28	0.00	0.0	0.4867
9.48	0.00	0.0	0.4867
10.15	0.00	0.0	0.4867
11.20	0.00	0.0	0.4867
12.30	0.00	0.0	0.4867
14.00	0.00	0.0	0.4867

Final Dial Reading: 0.00

Swell Pressure: 0 PSF

Heave = 0.000 % = 0.0000 inches/foot

SHRINKAGE DATA

Linear Shrinkage (Bar Method):

Linear Shrinkage: 4.0 %

Volumetric Shrinkage: 11.5 %

SECTION 00 4336

SUPPLEMENT A - LIST OF SUBCONTRACTORS

PARTICULARS

Herewith is the list of Subcontractors referenced in the bid submitted by:

Bidder: _____

To Owner: RANDOLPH COUNTY

Dated _____ and which is an integral part of the Bid Form.

The following work will be performed (or provided) by Subcontractors and coordinated by us:

LIST OF SUBCONTRACTORS

<u>WORK SUBJECT</u>	<u>SUBCONTRACTOR NAME</u>
HVAC CONTRACTOR	_____
PLUMBING CONTRACTOR	_____
ELECTRICAL CONTRACTOR	_____
ROOFING CONTRACTOR	_____
DIRT WORK	_____

END OF SUPPLEMENT A

SECTION 00 5000
CONTRACTING FORMS AND SUPPLEMENTS

PART 1 GENERAL

**1.01 CONTRACTOR IS RESPONSIBLE FOR OBTAINING A VALID LICENSE TO USE ALL
COPYRIGHTED DOCUMENTS SPECIFIED BUT NOT INCLUDED IN THE PROJECT MANUAL.**

1.02 AGREEMENT AND CONDITIONS OF THE CONTRACT

- A. See Section 00 5200 - Agreement Form for the Agreement form to be executed.
- B. See Section 00 7200 - General Conditions for the General Conditions.
- C. The Agreement is based on AIA A101.
- D. The General Conditions are based on AIA A201.

1.03 FORMS

- A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.
- B. Bond Forms:
 - 1. Performance and Payment Bond Form: AIA A312.
- C. Post-Award Certificates and Other Forms:
 - 1. Schedule of Values Form: AIA G703.
 - 2. Application for Payment Forms: AIA G702 with AIA G703 (for Contractors).
- D. Clarification and Modification Forms:
 - 1. Architect's Supplemental Instructions Form: AIA G710.
 - 2. Construction Change Directive Form: AIA G714.
 - 3. Change Order Form: AIA G701.
- E. Closeout Forms:
 - 1. Certificate of Substantial Completion Form: AIA G704.

1.04 REFERENCE STANDARDS

- A. AIA A101 - Standard Form of Agreement Between Owner and Contractor where the basis of Payment is a Stipulated Sum; 2017.
- B. AIA A201 - General Conditions of the Contract for Construction; 2017.
- C. AIA A312 - Performance Bond and Payment Bond; 2010.
- D. AIA G701 - Change Order; 2017.
- E. AIA G702 - Application and Certificate for Payment; 1992.
- F. AIA G703 - Continuation Sheet; 1992.
- G. AIA G704 - Certificate of Substantial Completion; 2017.
- H. AIA G710 - Architect's Supplemental Instructions; 2017.
- I. AIA G714 - Construction Change Directive; 2017.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 00 5200
AGREEMENT FORM**

PART 1 GENERAL

1.01 FORM OF AGREEMENT

**1.02 THE AGREEMENT TO BE EXECUTED IS ATTACHED FOLLOWING THIS PAGE OR AS
FOLLOWS:**

- A. Refer to Section 00 1100 AECDP Bid Package for General Contractors.

1.03 RELATED REQUIREMENTS

- A. Section 00 7200 - General Conditions.
- B. Section 00 7300 - Supplementary Conditions.
- C. Section 01 4216 - Definitions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

**SECTION 00 6000
PROJECT FORMS**

PART 1

1.01 BOND FORMS REQUIRED

1.02 BID BOND

1.03 EACH BID WILL INCLUDE WITH A BID BOND IN THE AMOUNT OF 5% OF THE TOTAL BID OFFERED IN THE FORM OF A CASHIER'S CHECK OR INSURANCE SURETY BOND (WITH POWER OF ATTORNEY ATTACHED) MADE PAYABLE TO THE OWNER.

1.04 PERFORMANCE AND PAYMENT BONDS:

- A. Performance and Payment Bonds, AIA Document A312, Current Edition
- B. A Performance and Payment bond will shall be furnished by the successful bidder within ten (10) days after receipt of the Owner's intent to award notice. Failure to furnish the required bonds may cause forfeiture of bid guarantee to the owner as liquidated damages.
- C. The "Performance and Payment Bond" will be in the amount equal to 100% of the contract price as security for the faithful performance of this contract price and for payment of all indebtedness for labor and materials furnished or performed in connection with this contract. The bond will be written by a surety company which is qualified and is authorized to do business in the State of Arkansas, according to AC.A. 22-9-402(a)(b) and filing with said bond, his power of attorney as his authority. The bond will be written in favor of the Contractor and executed per Arkansas state law. An original and two (2) copies of the bond must be furnished, with power of attorney attached to each. The Contractor will file and record the original with the Clerk in the Circuit Court of Randolph County. The Contractor is to pay all expense incidentals to file the bond. The remaining two copies should be certified by the Clerk to evidence the filing of the original and these two copies submitted to the Architect and Owner.
- D. Refer to Section 00 1100 AECDP Bid Package for General Contractors for additional requirements. AECDP Bid Package for General Contractors requirements shall supersede if a discrepancy exists.

1.05 INSURANCE CERTIFICATES REQUIRED:

- A. AIA G715 - 2017 Supplemental Attachment for Accord Certificate of Insurance 25.

END OF SECTION

SECTION 00 7200
GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

1.01 THE GENERAL CONDITIONS APPLICABLE TO THIS CONTRACT IS ATTACHED FOLLOWING THIS PAGE.

RELATED REQUIREMENTS

2.01 SECTION 00 7300 - SUPPLEMENTARY CONDITIONS.

2.02 SECTION 01 4216 - DEFINITIONS.

SUPPLEMENTARY CONDITIONS

3.01 REFER TO DOCUMENT 00 7300 - SUPPLEMENTARY CONDITIONS FOR AMENDMENTS TO THESE GENERAL CONDITIONS.

END OF SECTION

 **AIA**® **Document A201**® – 2017
General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

RANDOLPH COUNTY HEALTH UNIT
CAMP ROAD, POCAHONTAS, ARKANSAS

THE OWNER:

(Name, legal status and address)

RANDOLPH COUNTY, ARKANSAS
107 WEST BROADWAY
POCAHONTAS, ARKANSAS 72455

THE ARCHITECT:

(Name, legal status and address)

MATT SILAS ARCHITECT
212 EAST WASHINGTON AVE.
JONESBORO, ARKANSAS 72401

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

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

TABLE OF ARTICLES

- 1 **GENERAL PROVISIONS**
- 2 **OWNER**
- 3 **CONTRACTOR**
- 4 **ARCHITECT**
- 5 **SUBCONTRACTORS**
- 6 **CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**
- 7 **CHANGES IN THE WORK**
- 8 **TIME**
- 9 **PAYMENTS AND COMPLETION**
- 10 **PROTECTION OF PERSONS AND PROPERTY**
- 11 **INSURANCE AND BONDS**
- 12 **UNCOVERING AND CORRECTION OF WORK**
- 13 **MISCELLANEOUS PROVISIONS**
- 14 **TERMINATION OR SUSPENSION OF THE CONTRACT**
- 15 **CLAIMS AND DISPUTES**

Init.

INDEX

(Topics and numbers in bold are Section headings.)

Acceptance of Nonconforming Work

9.6.6, 9.9.3, **12.3**

Acceptance of Work

9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3

Access to Work

3.16, 6.2.1, 12.1

Accident Prevention

10

Acts and Omissions

3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5,

10.2.8, 13.3.2, 14.1, 15.1.2, 15.2

Addenda

1.1.1

Additional Costs, Claims for

3.7.4, 3.7.5, 10.3.2, 15.1.5

Additional Inspections and Testing

9.4.2, 9.8.3, 12.2.1, **13.4**

Additional Time, Claims for

3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, **15.1.6**

Administration of the Contract

3.1.3, **4.2**, 9.4, 9.5

Advertisement or Invitation to Bid

1.1.1

Aesthetic Effect

4.2.13

Allowances

3.8

Applications for Payment

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5.1, 9.5.4, 9.6.3, 9.7, 9.10

Approvals

2.1.1, 2.3.1, 2.5, 3.1.3, 3.10.2, 3.12.8, 3.12.9,

3.12.10.1, 4.2.7, 9.3.2, 13.4.1

Arbitration

8.3.1, 15.3.2, **15.4**

ARCHITECT

4

Architect, Definition of

4.1.1

Architect, Extent of Authority

2.5, 3.12.7, 4.1.2, 4.2, 5.2, 6.3, 7.1.2, 7.3.4, 7.4, 9.2,

9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1,

13.4.1, 13.4.2, 14.2.2, 14.2.4, 15.1.4, 15.2.1

Architect, Limitations of Authority and

Responsibility

2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2,

4.2.3, 4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4,

9.4.2, 9.5.4, 9.6.4, 15.1.4, 15.2

Architect's Additional Services and Expenses

2.5, 12.2.1, 13.4.2, 13.4.3, 14.2.4

Architect's Administration of the Contract

3.1.3, 3.7.4, 15.2, 9.4.1, 9.5

Architect's Approvals

2.5, 3.1.3, 3.5, 3.10.2, 4.2.7

Architect's Authority to Reject Work

3.5, 4.2.6, 12.1.2, 12.2.1

Architect's Copyright

1.1.7, 1.5

Architect's Decisions

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3,

7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1,

13.4.2, 15.2

Architect's Inspections

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.4

Architect's Instructions

3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.4.2

Architect's Interpretations

4.2.11, 4.2.12

Architect's Project Representative

4.2.10

Architect's Relationship with Contractor

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2,

3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16,

3.18, 4.1.2, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5,

9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.3.2, 13.4, 15.2

Architect's Relationship with Subcontractors

1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3

Architect's Representations

9.4.2, 9.5.1, 9.10.1

Architect's Site Visits

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

Asbestos

10.3.1

Attorneys' Fees

3.18.1, 9.6.8, 9.10.2, 10.3.3

Award of Separate Contracts

6.1.1, 6.1.2

Award of Subcontracts and Other Contracts for

Portions of the Work

5.2

Basic Definitions

1.1

Bidding Requirements

1.1.1

Binding Dispute Resolution

8.3.1, 9.7, 11.5, 13.1, 15.1.2, 15.1.3, 15.2.1, 15.2.5,

15.2.6.1, 15.3.1, 15.3.2, 15.3.3, 15.4.1

Bonds, Lien

7.3.4.4, 9.6.8, 9.10.2, 9.10.3

Bonds, Performance, and Payment

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**, 11.1.3, **11.5**

Building Information Models Use and Reliance

1.8

Building Permit

3.7.1

Capitalization

1.3

Certificate of Substantial Completion

9.8.3, 9.8.4, 9.8.5

Certificates for Payment

4.2.1, 4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.4

Certificates of Inspection, Testing or Approval
13.4.4

Certificates of Insurance

9.10.2

Change Orders

1.1.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11, 3.12.8, 4.2.8, 5.2.3, 7.1.2, 7.1.3, **7.2**, 7.3.2, 7.3.7, 7.3.9, 7.3.10, 8.3.1, 9.3.1.1, 9.10.3, 10.3.2, 11.2, 11.5, 12.1.2

Change Orders, Definition of

7.2.1

CHANGES IN THE WORK

2.2.2, 3.11, 4.2.8, **7**, 7.2.1, 7.3.1, 7.4, 8.3.1, 9.3.1.1, 11.5

Claims, Definition of

15.1.1

Claims, Notice of

1.6.2, 15.1.3

CLAIMS AND DISPUTES

3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, **15**, 15.4

Claims and Timely Assertion of Claims

15.4.1

Claims for Additional Cost

3.2.4, 3.3.1, 3.7.4, 7.3.9, 9.5.2, 10.2.5, 10.3.2, **15.1.5**

Claims for Additional Time

3.2.4, 3.3.1, 3.7.4, 6.1.1, 8.3.2, 9.5.2, 10.3.2, **15.1.6**

Concealed or Unknown Conditions, Claims for
3.7.4

Claims for Damages

3.2.4, 3.18, 8.3.3, 9.5.1, 9.6.7, 10.2.5, 10.3.3, 11.3, 11.3.2, 14.2.4, 15.1.7

Claims Subject to Arbitration

15.4.1

Cleaning Up

3.15, 6.3

Commencement of the Work, Conditions Relating to

2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3, 6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.2, **15.1.5**

Commencement of the Work, Definition of

8.1.2

Communications

3.9.1, **4.2.4**

Completion, Conditions Relating to

3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1, 9.10, 12.2, 14.1.2, 15.1.2

COMPLETION, PAYMENTS AND

9

Completion, Substantial

3.10.1, 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 15.1.2

Compliance with Laws

2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14.1.1, 14.2.1.3, 15.2.8, 15.4.2, 15.4.3

Concealed or Unknown Conditions

3.7.4, 4.2.8, 8.3.1, 10.3

Conditions of the Contract

1.1.1, 6.1.1, 6.1.4

Consent, Written

3.4.2, 3.14.2, 4.1.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 13.2, 15.4.4.2

Consolidation or Joinder

15.4.4

CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

1.1.4, **6**

Construction Change Directive, Definition of
7.3.1

Construction Change Directives

1.1.1, 3.4.2, 3.11, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3, **7.3**, 9.3.1.1

Construction Schedules, Contractor's

3.10, 3.11, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

Contingent Assignment of Subcontracts

5.4, 14.2.2.2

Continuing Contract Performance

15.1.4

Contract, Definition of

1.1.2

CONTRACT, TERMINATION OR SUSPENSION OF THE

5.4.1.1, 5.4.2, 11.5, **14**

Contract Administration

3.1.3, 4, 9.4, 9.5

Contract Award and Execution, Conditions Relating to

3.7.1, 3.10, 5.2, 6.1

Contract Documents, Copies Furnished and Use of
1.5.2, 2.3.6, 5.3

Contract Documents, Definition of

1.1.1

Contract Sum

2.2.2, 2.2.4, 3.7.4, 3.7.5, 3.8, 3.10.2, 5.2.3, 7.3, 7.4, **9.1**, 9.2, 9.4.2, 9.5.1.4, 9.6.7, 9.7, 10.3.2, 11.5, 12.1.2, 12.3, 14.2.4, 14.3.2, 15.1.4.2, **15.1.5**, **15.2.5**

Contract Sum, Definition of

9.1

Contract Time

1.1.4, 2.2.1, 2.2.2, 3.7.4, 3.7.5, 3.10.2, 5.2.3, 6.1.5, 7.2.1.3, 7.3.1, 7.3.5, 7.3.6, 7, 7, 7.3.10, 7.4, 8.1.1, 8.2.1, 8.2.3, 8.3.1, 9.5.1, 9.7, 10.3.2, 12.1.1, 12.1.2, 14.3.2, 15.1.4.2, 15.1.6.1, 15.2.5

Contract Time, Definition of

8.1.1

CONTRACTOR

3

Contractor, Definition of

3.1, **6.1.2**

Contractor's Construction and Submittal Schedules

3.10, 3.12.1, 3.12.2, 4.2.3, 6.1.3, 15.1.6.2

Contractor's Employees

2.2.4, 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3, 11.3, 14.1, 14.2.1.1

Contractor's Liability Insurance

11.1

Contractor's Relationship with Separate Contractors and Owner's Forces

3.12.5, 3.14.2, 4.2.4, 6, 11.3, 12.2.4

Contractor's Relationship with Subcontractors

1.2.2, 2.2.4, 3.3.2, 3.18.1, 3.18.2, 4.2.4, 5, 9.6.2, 9.6.7, 9.10.2, 11.2, 11.3, 11.4

Contractor's Relationship with the Architect

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.4, 15.1.3, 15.2.1

Contractor's Representations

3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2

Contractor's Responsibility for Those Performing the Work

3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8

Contractor's Review of Contract Documents

3.2

Contractor's Right to Stop the Work

2.2.2, 9.7

Contractor's Right to Terminate the Contract

14.1

Contractor's Submittals

3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2, 9.8.3, 9.9.1, 9.10.2, 9.10.3

Contractor's Superintendent

3.9, 10.2.6

Contractor's Supervision and Construction

Procedures

1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 7.3.6, 8.2, 10, 12, 14, 15.1.4

Coordination and Correlation

1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1

Copies Furnished of Drawings and Specifications

1.5, 2.3.6, 3.11

Copyrights

1.5, **3.17**

Correction of Work

2.5, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, **12.2**, 12.3, 15.1.3.1, 15.1.3.2, 15.2.1

Correlation and Intent of the Contract Documents

1.2

Cost, Definition of

7.3.4

Costs

2.5, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3, 7.3.3.3, 7.3.4, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.2, 12.1.2, 12.2.1, 12.2.4, 13.4, 14

Cutting and Patching

3.14, 6.2.5

Damage to Construction of Owner or Separate Contractors

3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 12.2.4

Damage to the Work

3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 12.2.4

Damages, Claims for

3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.3.2, 11.3, 14.2.4, 15.1.7

Damages for Delay

6.2.3, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 14.3.2

Date of Commencement of the Work, Definition of

8.1.2

Date of Substantial Completion, Definition of

8.1.3

Day, Definition of

8.1.4

Decisions of the Architect

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 6.3, 7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.4.2, 14.2.2, 14.2.4, 15.1, 15.2

Decisions to Withhold Certification

9.4.1, **9.5**, 9.7, 14.1.1.3

Defective or Nonconforming Work, Acceptance, Rejection and Correction of

2.5, 3.5, 4.2.6, 6.2.3, 9.5.1, 9.5.3, 9.6.6, 9.8.2, 9.9.3, 9.10.4, 12.2.1

Definitions

1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 5.1, 6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1

Delays and Extensions of Time

3.2, **3.7.4**, 5.2.3, 7.2.1, 7.3.1, **7.4**, **8.3**, 9.5.1, **9.7**, 10.3.2, **10.4**, 14.3.2, **15.1.6**, 15.2.5

Digital Data Use and Transmission

1.7

Disputes

6.3, 7.3.9, 15.1, 15.2

Documents and Samples at the Site

3.11

Drawings, Definition of

1.1.5

Drawings and Specifications, Use and Ownership of

3.11

Effective Date of Insurance

8.2.2

Emergencies

10.4, 14.1.1.2, **15.1.5**

Employees, Contractor's

3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3.3, 11.3, 14.1, 14.2.1.1

Equipment, Labor, or Materials

1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2

Execution and Progress of the Work

1.1.3, 1.2.1, 1.2.2, 2.3.4, 2.3.6, 3.1, 3.3.1, 3.4.1, 3.7.1, 3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.6, 8.2, 9.5.1, 9.9.1, 10.2, 10.3, 12.1, 12.2, 14.2, 14.3.1, 15.1.4

Extensions of Time

3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2, 10.4, 14.3, 15.1.6, **15.2.5**

Failure of Payment

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Faulty Work
(See Defective or Nonconforming Work)

Final Completion and Final Payment
4.2.1, 4.2.9, 9.8.2, **9.10**, 12.3, 14.2.4, 14.4.3

Financial Arrangements, Owner's
2.2.1, 13.2.2, 14.1.1.4

GENERAL PROVISIONS

1

Governing Law

13.1
Guarantees (See Warranty)

Hazardous Materials and Substances
10.2.4, **10.3**

Identification of Subcontractors and Suppliers
5.2.1

Indemnification
3.17, **3.18**, 9.6.8, 9.10.2, 10.3.3, 11.3

Information and Services Required of the Owner
2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10.1, 6.1.3, 6.1.4, 6.2.5,
9.6.1, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2,
14.1.1.4, 14.1.4, 15.1.4

Initial Decision

15.2

Initial Decision Maker, Definition of
1.1.8

Initial Decision Maker, Decisions
14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Initial Decision Maker, Extent of Authority
14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Injury or Damage to Person or Property
10.2.8, 10.4

Inspections
3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,
9.9.2, 9.10.1, 12.2.1, 13.4

Instructions to Bidders
1.1.1

Instructions to the Contractor
3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.4.2

Instruments of Service, Definition of
1.1.7

Insurance
6.1.1, 7.3.4, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5,
11

Insurance, Notice of Cancellation or Expiration
11.1.4, 11.2.3

Insurance, Contractor's Liability

11.1
Insurance, Effective Date of
8.2.2, 14.4.2

Insurance, Owner's Liability

11.2

Insurance, Property
10.2.5, 11.2, 11.4, 11.5

Insurance, Stored Materials
9.3.2

INSURANCE AND BONDS

11

Insurance Companies, Consent to Partial Occupancy
9.9.1

Insured loss, Adjustment and Settlement of
11.5

Intent of the Contract Documents
1.2.1, 4.2.7, 4.2.12, 4.2.13

Interest

13.5

Interpretation
1.1.8, 1.2.3, **1.4**, 4.1.1.1, 5.1, 6.1.2, 15.1.1

Interpretations, Written
4.2.11, 4.2.12

Judgment on Final Award
15.4.2

Labor and Materials, Equipment
1.1.3, 1.1.6, **3.4**, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,
5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1,
10.2.4, 14.2.1.1, 14.2.1.2

Labor Disputes
8.3.1

Laws and Regulations
1.5, 2.3.2, 3.2.3, 3.2.4, 3.6, 3.7, 3.12.10, 3.13, 9.6.4,
9.9.1, 10.2.2, 13.1, 13.3.1, 13.4.2, 13.5, 14, 15.2.8,
15.4

Liens
2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Limitations, Statutes of
12.2.5, 15.1.2, 15.4.1.1

Limitations of Liability
3.2.2, 3.5, 3.12.10, 3.12.10.1, 3.17, 3.18.1, 4.2.6,
4.2.7, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 9.6.8, 10.2.5, 10.3.3,
11.3, 12.2.5, 13.3.1

Limitations of Time
2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7,
5.2, 5.3, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3,
9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15,
15.1.2, 15.1.3, 15.1.5

Materials, Hazardous
10.2.4, **10.3**

Materials, Labor, Equipment and
1.1.3, 1.1.6, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,
5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2,
10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2

Means, Methods, Techniques, Sequences and
Procedures of Construction
3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2

Mechanic's Lien
2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Mediation
8.3.1, 15.1.3.2, 15.2.1, 15.2.5, 15.2.6, **15.3**, 15.4.1,
15.4.1.1

Minor Changes in the Work
1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1, **7.4**

MISCELLANEOUS PROVISIONS

13

Modifications, Definition of

1.1.1

Modifications to the Contract
1.1.1, 1.1.2, 2.5, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7,
10.3.2

Mutual Responsibility

6.2

Nonconforming Work, Acceptance of

9.6.6, 9.9.3, **12.3**

Nonconforming Work, Rejection and Correction of
2.4, 2.5, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4,
12.2

Notice

1.6, 1.6.1, 1.6.2, 2.1.2, 2.2.2., 2.2.3, 2.2.4, 2.5, 3.2.4,
3.3.1, 3.7.4, 3.7.5, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 7.4,
8.2.2 9.6.8, 9.7, 9.10.1, 10.2.8, 10.3.2, 11.5, 12.2.2.1,
13.4.1, 13.4.2, 14.1, 14.2.2, 14.4.2, 15.1.3, 15.1.5,
15.1.6, 15.4.1

Notice of Cancellation or Expiration of Insurance

11.1.4, 11.2.3

Notice of Claims

1.6.2, 2.1.2, 3.7.4, 9.6.8, 10.2.8, **15.1.3**, 15.1.5,
15.1.6, 15.2.8, 15.3.2, 15.4.1

Notice of Testing and Inspections

13.4.1, 13.4.2

Observations, Contractor's

3.2, 3.7.4

Occupancy

2.3.1, 9.6.6, 9.8

Orders, Written

1.1.1, 2.4, 3.9.2, 7, 8.2.2, 11.5, 12.1, 12.2.2.1, 13.4.2,
14.3.1

OWNER

2

Owner, Definition of

2.1.1

Owner, Evidence of Financial Arrangements

2.2, 13.2.2, 14.1.1.4

Owner, Information and Services Required of the

2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5,
9.3.2, 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1,
13.4.2, 14.1.1.4, 14.1.4, 15.1.4

Owner's Authority

1.5, 2.1.1, 2.3.3.2.4, 2.5, 3.4.2, 3.8.1, 3.12.10, 3.14.2,
4.1.2, 4.2.4, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3, 7.2.1,
7.3.1, 8.2.2, 8.3.1, 9.3.2, 9.5.1, 9.6.4, 9.9.1, 9.10.2,
10.3.2, 11.4, 11.5, 12.2.2, 12.3, 13.2.2, 14.3, 14.4,
15.2.7

Owner's Insurance

11.2

Owner's Relationship with Subcontractors

1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2

Owner's Right to Carry Out the Work

2.5, 14.2.2

Owner's Right to Clean Up

6.3

**Owner's Right to Perform Construction and to
Award Separate Contracts**

6.1

Owner's Right to Stop the Work

2.4

Owner's Right to Suspend the Work

14.3

Owner's Right to Terminate the Contract

14.2, 14.4

**Ownership and Use of Drawings, Specifications
and Other Instruments of Service**

1.1.1, 1.1.6, 1.1.7, **1.5**, 2.3.6, 3.2.2, 3.11, 3.17, 4.2.12,
5.3

Partial Occupancy or Use

9.6.6, **9.9**

Patching, Cutting and

3.14, 6.2.5

Patents

3.17

Payment, Applications for

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5, 9.6.3, 9.7, 9.8.5, 9.10.1,
14.2.3, 14.2.4, 14.4.3

Payment, Certificates for

4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1,
9.10.3, 14.1.1.3, 14.2.4

Payment, Failure of

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Payment, Final

4.2.1, 4.2.9, **9.10**, 12.3, 14.2.4, 14.4.3

Payment Bond, Performance Bond and

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Payments, Progress

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

PAYMENTS AND COMPLETION

9

Payments to Subcontractors

5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7, 14.2.1.2

PCB

10.3.1

Performance Bond and Payment Bond

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Permits, Fees, Notices and Compliance with Laws

2.3.1, **3.7**, 3.13, 7.3.4.4, 10.2.2

PERSONS AND PROPERTY, PROTECTION

OF

10

Polychlorinated Biphenyl

10.3.1

Product Data, Definition of

3.12.2

Product Data and Samples, Shop Drawings

3.11, **3.12**, 4.2.7

Progress and Completion

4.2.2, **8.2**, 9.8, 9.9.1, 14.1.4, 15.1.4

Progress Payments

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

Project, Definition of

1.1.4

Project Representatives

4.2.10

Property Insurance

10.2.5, 11.2

Proposal Requirements

1.1.1

**PROTECTION OF PERSONS AND PROPERTY
10**

Regulations and Laws

1.5, 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1,
10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14, 15.2.8,
15.4

Rejection of Work

4.2.6, 12.2.1

Releases and Waivers of Liens

9.3.1, 9.10.2

Representations

3.2.1, 3.5, 3.12.6, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.10.1

Representatives

2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.10, 13.2.1

Responsibility for Those Performing the Work

3.3.2, 3.18, 4.2.2, 4.2.3, 5.3, 6.1.3, 6.2, 6.3, 9.5.1, 10

Retainage

9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3

Review of Contract Documents and Field**Conditions by Contractor****3.2, 3.12.7, 6.1.3**Review of Contractor's Submittals by Owner and
Architect

3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2

Review of Shop Drawings, Product Data and
Samples by Contractor

3.12

Rights and Remedies1.1.2, 2.4, 2.5, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1,
6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.1, 12.2.2,
12.2.4, 13.3, 14, 15.4**Royalties, Patents and Copyrights****3.17**

Rules and Notices for Arbitration

15.4.1

Safety of Persons and Property**10.2, 10.4****Safety Precautions and Programs**

3.3.1, 4.2.2, 4.2.7, 5.3, 10.1, 10.2, 10.4

Samples, Definition of**3.12.3****Samples, Shop Drawings, Product Data and****3.11, 3.12, 4.2.7****Samples at the Site, Documents and****3.11****Schedule of Values****9.2, 9.3.1**

Schedules, Construction

3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

Separate Contracts and Contractors

1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2

Separate Contractors, Definition of**6.1.1****Shop Drawings, Definition of****3.12.1****Shop Drawings, Product Data and Samples**

3.11, 3.12, 4.2.7

Site, Use of**3.13, 6.1.1, 6.2.1**

Site Inspections

3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.9.2, 9.4.2, 9.10.1, 13.4

Site Visits, Architect's

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

Special Inspections and Testing

4.2.6, 12.2.1, 13.4

Specifications, Definition of**1.1.6****Specifications**

1.1.1, 1.1.6, 1.2.2, 1.5, 3.12.10, 3.17, 4.2.14

Statute of Limitations

15.1.2, 15.4.1.1

Stopping the Work

2.2.2, 2.4, 9.7, 10.3, 14.1

Stored Materials

6.2.1, 9.3.2, 10.2.1.2, 10.2.4

Subcontractor, Definition of**5.1.1****SUBCONTRACTORS****5**

Subcontractors, Work by

1.2.2, 3.3.2, 3.12.1, 3.18, 4.2.3, 5.2.3, 5.3, 5.4,
9.3.1.2, 9.6.7**Subcontractual Relations****5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1**

Submittals

3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.4, 9.2, 9.3,
9.8, 9.9.1, 9.10.2, 9.10.3

Submittal Schedule

3.10.2, 3.12.5, 4.2.7

Subrogation, Waivers of

6.1.1, 11.3

Substances, Hazardous**10.3****Substantial Completion**4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3,
12.2, 15.1.2**Substantial Completion, Definition of****9.8.1**

Substitution of Subcontractors

5.2.3, 5.2.4

Substitution of Architect

2.3.3

Substitutions of Materials

3.4.2, 3.5, 7.3.8

Sub-subcontractor, Definition of**5.1.2**

Subsurface Conditions

3.7.4

Successors and Assigns**13.2**

Superintendent

3.9, 10.2.6

Supervision and Construction Procedures

1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.4

Suppliers

1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.5.4, 9.6, 9.10.5, 14.2.1

Surety

5.4.1.2, 9.6.8, 9.8.5, 9.10.2, 9.10.3, 11.1.2, 14.2.2, 15.2.7

Surety, Consent of

9.8.5, 9.10.2, 9.10.3

Surveys

1.1.7, 2.3.4

Suspension by the Owner for Convenience

14.3

Suspension of the Work

3.7.5, 5.4.2, 14.3

Suspension or Termination of the Contract

5.4.1.1, 14

Taxes

3.6, 3.8.2.1, 7.3.4.4

Termination by the Contractor

14.1, 15.1.7

Termination by the Owner for Cause

5.4.1.1, 14.2, 15.1.7

Termination by the Owner for Convenience

14.4

Termination of the Architect

2.3.3

Termination of the Contractor Employment

14.2.2

TERMINATION OR SUSPENSION OF THE CONTRACT

14

Tests and Inspections

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 10.3.2, 12.2.1, 13.4

TIME

8

Time, Delays and Extensions of

3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, 8.3, 9.5.1, 9.7, 10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5

Time Limits

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2, 5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3,

9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15.1.2, 15.1.3, 15.4

Time Limits on Claims

3.7.4, 10.2.8, 15.1.2, 15.1.3

Title to Work

9.3.2, 9.3.3

UNCOVERING AND CORRECTION OF WORK

12

Uncovering of Work

12.1

Unforeseen Conditions, Concealed or Unknown

3.7.4, 8.3.1, 10.3

Unit Prices

7.3.3.2, 9.1.2

Use of Documents

1.1.1, 1.5, 2.3.6, 3.12.6, 5.3

Use of Site

3.13, 6.1.1, 6.2.1

Values, Schedule of

9.2, 9.3.1

Waiver of Claims by the Architect

13.3.2

Waiver of Claims by the Contractor

9.10.5, 13.3.2, 15.1.7

Waiver of Claims by the Owner

9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.3.2, 14.2.4, 15.1.7

Waiver of Consequential Damages

14.2.4, 15.1.7

Waiver of Liens

9.3, 9.10.2, 9.10.4

Waivers of Subrogation

6.1.1, 11.3

Warranty

3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.2, 9.10.4, 12.2.2, 15.1.2

Weather Delays

8.3, 15.1.6.2

Work, Definition of

1.1.3

Written Consent

1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.10.3, 13.2, 13.3.2, 15.4.4.2

Written Interpretations

4.2.11, 4.2.12

Written Orders

1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk

and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in

such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. 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. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or

equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages,

compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of

other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or

(3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by

an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract

Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in

Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

AIA Document A201® – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017 by The American Institute of Architects. All rights reserved. The "American Institute of Architects," "AIA," the AIA Logo, "A201," and "AIA Contract Documents" are registered trademarks and may not be used without permission. This document was created on 01/10/2021 14:36:18 under the terms of AIA Documents on Demand® Order No. 2010651897, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Documents-on-Demand - End User License Agreement. To report copyright violations, e-mail copyright@aia.org.

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or Suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand

for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

**SECTION 00 7300
SUPPLEMENTARY CONDITIONS**

PART 1 GENERAL

1.01 SUMMARY

- A. These Supplementary Conditions amend and supplement the General Conditions defined in Document 00 7200 and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.
- B. The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

PART 4 MODIFICATIONS TO AIA A201

4.01 ARTICLE 2.2 - INFORMATION AND SERVICES REQUIRED OF THE OWNER

4.02 ARTICLE 3.4 - LABOR AND MATERIALS

- A. Add the following paragraphs:
 - 1. 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 in the General Requirements (Division 1 of the Specifications).
 - 2. 3.4.5 By making requests for substitutions based on Subparagraph 3.4.4 above, 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 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 except that Architect's redesign costs, and waives all claims 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 completed in all respects.

4.03 ARTICLE 3.18 - INDEMNIFICATION

- A. Article 3.18.1 - The first sentence is amended to read as follows: To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's Consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury or destruction to tangible property (other than the Work itself) including loss of use resulting there from, but only to the extent caused in whole or in part by negligent reckless or intentional acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a part indemnified hereunder.

4.04 ARTICLE 5 - SUBCONTRACTORS

- A. Add the following subparagraph:
 - 1. 5.2.1.1 Not later than 15 days after the date of NOTICE TO PROCEED, the Contractor shall furnish in writing to the Architect the names of persons or entities proposed as manufacturers for each of the product identified in the General Requirements (Division 1 of the Specifications) and, where applicable, the names of the installing Subcontractor.

4.05 ARTICLE 8 - TIME

- A. Add the following subparagraph:

1. 8.1.5: Contract Time is identified in the project manual.

4.06 ARTICLE 9.6 - PROGRESS PAYMENTS

- A. Add the following sentence to 9.6.4.
 1. The Contractor shall provide lien releases from subcontractors and suppliers directly engaged by the Contractor as follows:
 - a. at 50% project completion;
 - b. at end of project with last pay application.
- B. Add the following subparagraph:
 1. 9.6.9 The Owner may nullify the whole or any part of any Certificate for Payment previously issued, to such extend as may be necessary in its opinion to protect the Owner from loss because of:
 - a. 1. Defective work not remedied;
 - b. 2. Third party claims filed or reasonable evidence indicating problem filing to such claims;
 - c. 3. Failure of the contractor to make payments properly to subcontractors or for labor, materials, or equipment;
 - d. 4. Reasonable evidence that the work cannot be completed for the unpaid balance of the contract sum;
 - e. 5. Damage to the Owner or another contractor;
 - f. 6. Reasonable evidence that the work will not be completed within the contract time;
 - g. 7. Persistent failure to carry out the work in accordance with the contract documents.

4.07 ARTICLE 10.2 - SAFETY OF PERSONS AND PROPERTY

- A. Add the following sentence at the end of paragraph:
 1. The Contractor shall give the Owner seven days advance notice prior to such activities being implemented.

4.08 ARTICLE 11 - INSURANCE AND BONDS

- A. Refer to 11.1.1
 1. Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis including:
 - a. Premises Operations (including X, C, and U coverage's as applicable).
 - b. Independent Contractor's Protective.
 - c. Products and Completed Operations.
 - d. Personal Injury Liability with Employment Exclusion deleted.
 - e. Contractual, including specified provisions for Contractor's obligation under Paragraph 3.18.
 - f. Owned, non-owned and hired motor vehicles.
 - g. Broad Form Property Damage including Completed Operations.
 2. Add 11.1.1.1
 - a. The Insurance shall be written for not less than the following limits, or greater if required by law:
 - 1) Workmen's Compensation - Statutory Requirements.
 - 2) Comprehensive General Liability Insurance shall be maintained with aggregate limit of not less than \$2,000,000.00.
 - 3) Comprehensive Automobile Liability Insurance \$500,000.00 combined single limit for both Bodily Injury and Property Damage.
 - 4) Owner's and Contractor's Protective Liability Insurance shall be maintained with aggregate limit not less than \$2,000,000.00, with Architect as additional insured.
 - 5) 11.1.2.2 Furnish Certificates of Insurance, AIA Documents G705, three copies, showing required insurance is in force before starting contract work. Furnish copies of subsequent endorsements amending coverage or limits.

END OF DOCUMENT

SECTION 01 2000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.
- E. Procedures for preparation and submittal of application for final payment.

1.02 SCHEDULE OF VALUES

- A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization and bonds and insurance.
- F. Include in each line item, the amount of Allowances specified in this section.
- G. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- H. Revise schedule to list approved Change Orders, with each Application For Payment.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.
 - 10. Retainage.
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- I. Submit one electronic and 0 hard-copies of each Application for Payment.
- J. Include the following with the application:

1. Transmittal letter as specified for submittals in Section 01 3000.
 2. Construction progress schedule, revised and current as specified in Section 01 3000.
 3. Partial release of liens from major subcontractors and vendors.
 4. Affidavits attesting to off-site stored products.
- K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.04 MODIFICATION PROCEDURES

- A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 2. Promptly execute the change.
- C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 5 days.
- D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 6000.
- E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
 4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- F. Substantiation of Costs: Provide full information required for evaluation.
 1. On request, provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

- H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- J. Promptly enter changes in Project Record Documents.

1.05 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:

END OF SECTION

**SECTION 01 2100
ALLOWANCES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Contingency allowance.
- B. Inspecting and testing allowances.
- C. Landscaping allowance.
- D. Undercutting and fill replacement allowance.

1.02 CONTINGENCY ALLOWANCE

- A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.
- B. Funds will be drawn from the Contingency Allowance only by Change Order.
- C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.03 INSPECTING AND TESTING ALLOWANCES

- A. Costs Included in Inspecting and Testing Allowances: Cost of engaging an inspecting or testing agency; execution of inspecting and tests; and reporting results.
- B. Payment Procedures:
 - 1. Submit one copy of the inspecting or testing firm's invoice with next application for payment.
- C. Differences in cost will be adjusted by Change Order.

1.04 LANDSCAPING ALLOWANCE

- A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit to be included.
- B. Extent and type of landscaping to be determined by the owner. The contractor shall coordinate with the Owner and provide an itemized list of materials and features to be installed.

1.05 UNDERCUTTING AND FILL REPLACEMENT ALLOWANCE

- A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit to be included.
- B. Basis of allowance is as follows:
 - 1. Building Slab and Footing Area: 5,000 square feet.
 - 2. Depth: 2 feet.
 - 3. Cost: \$20 per cubic yard.
 - a. Price indicated is installed cost and includes, but not limited to, removal of unsuitable soil, new fill material, installation, labor, hauling and compaction.
- C. Proof-rolling Existing Site: Proof-rolling shall occur per geotechnical report with the guidance and observation of geotechnical engineer prior to undercutting. Proceed with undercutting only if geotechnical engineer determines undercutting is warranted due to discovery of soft or inadequate soils.

1.06 ALLOWANCES SCHEDULE

- A. Contingency Allowance: Include the stipulated sum/price of \$10,000.00 for use upon Owner's instructions.
- B. Inspecting and Testing Allowance: Include the sum of \$3,500.00 for payment of inspecting services specified in Section 01 4000 - Quality Requirements.
- C. Landscaping Allowance: Include the stipulated sum/price of \$[10,000.00] for use upon Owner's instructions.

D. Undercutting and Fill Replacement Allowance: Include the stipulated sum / price of \$[7,500.00].

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 2500
SUBSTITUTION PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 - b. Regulatory changes.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. A Substitution Request for specified installer constitutes a representation that the submitter:
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. No specific form is required. Contractor's Substitution Request documentation must include the following:
 - a. Project Information:
 - 1) Official project name, and any additional required identifiers established in Contract Documents.
 - 2) Owner's, Architect's, and Contractor's names.
 - b. Substitution Request Information:
 - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
 - 2) Indication of whether the substitution is for cause or convenience.
 - 3) Issue date.
 - 4) Description of Substitution.
 - 5) Reason why the specified item cannot be provided.

- 6) Differences between proposed substitution and specified item.
- 7) Description of how proposed substitution affects other parts of work.
- c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
 - 1) Physical characteristics.
 - 2) In-service performance.
 - 3) Expected durability.
 - 4) Visual effect.
 - 5) Warranties.
 - 6) Other salient features and requirements.
 - 7) Include, as appropriate or requested, the following types of documentation:
 - (a) Product Data:
 - (b) Samples.
 - (c) Drawings, when required to show impact on adjacent construction elements.
- d. Impact of Substitution:
 - 1) Savings to Owner for accepting substitution.
 - 2) Change to Contract Time due to accepting substitution.
- E. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Architect will consider requests for substitutions only within 30 days after date of Agreement.

3.04 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

3.05 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

END OF SECTION

**SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electronic document submittal service.
- B. Preconstruction meeting.
- C. Site mobilization meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Coordination drawings.
- G. Number of copies of submittals.
- H. Requests for Information (RFI) procedures.
- I. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements: General product requirements.

1.03 REFERENCE STANDARDS

- A. AIA G716 - Request for Information; 2004.
- B. AIA G810 - Transmittal Letter; 2001.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 - 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 - 2. Contractor and Architect are required to use this service.
 - 3. It is Contractor's responsibility to submit documents in allowable format.
 - 4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
 - 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 - 6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 - 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.
- C. Submittal Service: The selected service is:
 - 1. Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com/#sle.

- D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
- E. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

- A. Schedule meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 5. Designation of personnel representing the parties to Contract, Owner and Architect.
 - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 7. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

- A. Schedule meeting at the Project site prior to Contractor occupancy.
- B. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect.
 - 4. Contractor's superintendent.
 - 5. Major subcontractors.
- C. Agenda:
 - 1. Use of premises by Owner and Contractor.
 - 2. Owner's requirements.
 - 3. Construction facilities and controls provided by Owner.
 - 4. Temporary utilities provided by Owner.
 - 5. Survey and building layout.
 - 6. Security and housekeeping procedures.
 - 7. Schedules.
 - 8. Application for payment procedures.
 - 9. Procedures for testing.
 - 10. Procedures for maintaining record documents.
 - 11. Requirements for start-up of equipment.
 - 12. Inspection and acceptance of equipment put into service during construction period.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect.
 - 4. Contractor's superintendent.
 - 5. Major subcontractors.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems that impede, or will impede, planned progress.
 - 5. Review of submittals schedule and status of submittals.
 - 6. Maintenance of progress schedule.
 - 7. Corrective measures to regain projected schedules.
 - 8. Planned progress during succeeding work period.
 - 9. Maintenance of quality and work standards.
 - 10. Effect of proposed changes on progress schedule and coordination.
 - 11. Other business relating to work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE

- A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- C. Within 10 days after joint review, submit complete schedule.
- D. Submit updated schedule with each Application for Payment.

3.06 COORDINATION DRAWINGS

- A. Review drawings prior to submission to Architect.

3.07 REQUESTS FOR INFORMATION (RFI)

- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.

2. Prepare in a format and with content acceptable to Owner.
 - a. Use AIA G716 - Request for Information .
 3. Prepare using software provided by the Electronic Document Submittal Service.
 4. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 2. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response.
 3. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, the Contract Documents, with no additional input required to clarify the question. They will be returned without a response.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 2. Owner's, Architect's, and Contractor's names.
 3. Discrete and consecutive RFI number, and descriptive subject/title.
 4. Issue date, and requested reply date.
 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- G. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.08 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

3.09 SUBMITTAL PROCEDURES

- A. Refer to paragraph 3.01 Electronic Document Submittal Service.
- B. General Requirements:
 1. Transmit using approved form.
 - a. Use Form AIA G810 or similar form.
 2. Sequentially identify each item. For revised submittals use original number and a sequential alphabetical / numerical suffix.
 3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 5. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
 6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 7. Provide space for Contractor and Architect review stamps.
 8. When revised for resubmission, identify all changes made since previous submission.
 9. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 10. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 11. Submittals not requested will not be recognized or processed.
- C. Product Data Procedures:
 1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Do not submit (Material) Safety Data Sheets for materials or products.
- D. Shop Drawing Procedures:
 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Do not reproduce Contract Documents to create shop drawings.
 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- E. Samples Procedures:
 1. Transmit related items together as single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.10 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

- B. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
 - 1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

END OF SECTION

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 REFERENCE STANDARDS

- A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.
- B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; 2015.

1.03 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.
- F. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.
- G. Submit under transmittal letter form specified in Section 01 3000 - Administrative Requirements.

1.04 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum 11 x 17 inches (_____ mm) or width required.
- C. Sheet Size: Multiples of 8-1/2 x 11 inches (216 x 280 mm).
- D. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
- D. Provide sub-schedules for each stage of Work identified in Section 01 1000 - Summary.
- E. Provide sub-schedules to define critical portions of the entire schedule.
- F. Include conferences and meetings in schedule.
- G. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

- H. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- I. Indicate delivery dates for owner-furnished products.
- J. Coordinate content with schedule of values specified in Section 01 2000 - Price and Payment Procedures.
- K. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

**SECTION 01 3300
WEATHER DELAYS**

PART 1 GENERAL

1.01 EXTENSIONS OF TIME CONTRACT

- A. If the basis exists for an extension of time in accordance with paragraph 8.3 of the General Conditions, an extension of item on the basis of weather may be granted only for the number of Weather Delay Days in excess of the number of days listed as the Standard Baseline for that month.
- B. The owner is not obligated to grant the extension of time but will take under consideration if an extension of time is warranted due to unforeseen circumstances. It shall be the responsibility of the Contractor to record all adverse weather days based on information in this section.

1.02 STANDARD BASELINE FOR CLIMATE RANGE

- A. Standard Baseline shall be regarded as the normal and anticipatable number of calendar days for each month during which construction activity shall be expected to be prevented and suspended by cause of adverse weather. Suspension of construction activity for the number of days each month as listed in the standard baseline is included in the work and not eligible for extension of contract time.
- B. Standard Baseline is as follows:

1.03 ADVERSE WEATHER AND WEATHER DELAYS

- A. Adverse Weather is defined as the occurrence of one or more of the following conditions which prevents exterior construction activity or access to the site within twenty-four (24) hours:
 - 1. Precipitation (rain, snow, or ice) in excess of one-tenth inch (0.10") liquid measure
 - 2. Temperatures that do not rise above 32 degrees F. by 10:00 a.m.
 - 3. Temperatures that do not rise above that specified for the days construction activity by 10:00 a.m., if any is specified.
 - 4. Sustained wind in excess of twenty-five (25) miles per hour.
 - 5. Standing snow in excess of one inch (1.00")
- B. Adverse Weather may include, if appropriate, "dry" or "mud" days when all the following conditions are met:
 - 1. For rain days above the standard baseline.
 - 2. Only if there is a hindrance to site access to Work, such as excavation, backfill, and footings.
 - 3. At a rate no greater than 1 make-up day for each day or consecutive rain days beyond the standard baseline that total 1 inch or more, liquid measure, unless specifically recommended otherwise by the Designer.
- C. A Weather Delay Day may be counted if adverse weather prevents work on the project for fifty percent (50%) or more of the contractor's scheduled work day, including a weekend day or holiday if Contractor has scheduled construction activity that day.

1.04 DOCUMENTATION AND SUBMITTALS

- A. Submit daily jobsite logs showing which and to what extent construction activities have been affected by weather on a monthly basis.
- B. Submit actual weather data to support claim for time extension obtained from nearest NOAA weather station or other independently verified source approved by Architect at beginning of project.
- C. Use Standard Baseline data provided in this Section when documenting actual delays due to weather in excess of the average climatic range.
- D. Organize claim and documentation to facilitate evaluation on a basis of calendar month periods, and submit in accordance with the procedures for Claims established in Article 15 of the General Conditions.

- E. If an extension of the Contract Time is appropriate, it shall be effected in accordance with the provisions of Article 7 of the General Conditions, and the applicable General Requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS**PART 1 GENERAL****1.01 SUMMARY**

- A. This Section includes administrative and procedural requirements for quality assurance, quality control, and IBC required special inspections.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.02 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.
- D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.03 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Description of test and inspection.
 - 3. Identification of applicable standards.
 - 4. Identification of test and inspection methods.
 - 5. Number of tests and inspections required.
 - 6. Time schedule or time span for tests and inspections.
 - 7. Entity responsible for performing tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- C. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.

6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Ambient conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.
- G. Pre-Construction Testing: Testing agency shall perform pre-construction testing for compliance with specified requirements for performance and test methods.
 1. Contractor responsibilities include the following:
 - a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Fabricate and install test assemblies using installers who will perform the same tasks for Project.
 - d. When testing is complete, remove assemblies; do not reuse materials on Project.
 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- H. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.05 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will employ and pay for a qualified testing agency to perform these services.
 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
 1. Quality Assurance and Control of Installation: Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
 - a. Comply fully with manufacturers' instructions.
 - b. Comply with specified standards as a minimum quality level for the Work, except when more stringent tolerances, code requirements, or other specified requirements indicate higher standards or more precise workmanship.
 - c. Tolerances: Monitor tolerance control of product installation to assure acceptable work. Do not permit tolerance margins to accumulate and result in non-conforming work.
 - 1) Comply with specified, referenced, and/or manufacturers' tolerances, whichever is most restrictive.
 - 2) Adjust products to appropriate dimensions and position before securing in place.
 2. Quality Control and Testing Services: Where testing services are indicated as Contractor's responsibility, engage and pay for a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ the same entity engaged by Owner, unless agreed to in writing by Owner.
 - b. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - c. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - d. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - e. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Special Tests and Inspections per Chapter 17 of the Building Code.
 1. This project is exempted per AFPC 2012, Chapter 17, Section 1704.2, Exception 3.
- D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- E. Retesting / Re-Inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for

construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field-curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.06 TESTING AND INSPECTION AGENCIES

- A. Construction Manager Employed Agency:
 - 1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, and ASTM C1093.
 - 2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
 - 3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
 - 4. Laboratory: Authorized to operate in Jonesboro, Arkansas.
 - 5. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from the Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from the Architect before proceeding.

- C. Adjust products to appropriate dimensions; position before securing products in place.

3.03 TESTING AND INSPECTION

- A. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with the Architect and the Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify the Architect and of observed irregularities or non-conformance of Work or products.
 - 5. Perform additional tests and inspections required by the Architect.
 - 6. Submit reports of all tests/inspections specified.
- B. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of.
 - 4. Agency has no authority to stop the Work.
- C. Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify the Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by beyond specified requirements.
 - 6. Arrange with the Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by the Architect.
- E. Re-testing required because of non-conformance to specified requirements shall be paid for by.
- F. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by the Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Sum.

3.04 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements.

- B. If, in the opinion of the Architect, it is not practical to remove and replace the Work, the Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

**SECTION 01 4100
REGULATORY REQUIREMENTS**

PART 1 GENERAL

1.01 SUMMARY

- A. Regulatory requirements applicable to this project are the following:
1. 29 CFR 1910 - Occupational Safety and Health Standards; current edition; as a work place.
 2. ARKANSAS FIRE PREVENTION CODE 2012 (AFPC) - VOLUMES I AND II.
 3. NFPA 101 - Life Safety Code.
 4. Plumbing Code: Arkansas, 2006.
 5. Mechanical Code: Arkansas, 2010.
 6. Fuel Gas Code: Arkansas, 2006.
 7. National Electrical Code, 2017
 8. Energy Code: 2014 Arkansas Energy Code.
 9. Americans with Disabilities Act (ADA) Standards For Accessible Design; 2010.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 4216
DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.
- E. Provide: To furnish and install.
- F. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telephone service.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures and fencing.
- E. Vehicular access and parking.
- F. Waste removal facilities and services.
- G. Project identification sign.
- H. Field offices.

1.02 TEMPORARY UTILITIES

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities outside of building area. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.04 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect adjacent properties from damage from construction operations.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way when required.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.05 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.06 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and the Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide temporary parking areas to accommodate construction personnel.

1.07 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.

- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.08 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore new permanent facilities used during construction to specified condition.

1.09 SECURITY

- A. Provide security and facilities to protect Work and Owner's operations from unauthorized entry, vandalism or theft.
- B. Coordinate with the Owner's security program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5713

TEMPORARY EROSION / SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SCOPE

- A. Under regulation of the Department of Pollution Control and Ecology, the owner shall be responsible for implementing pollution control methods for controlling storm water run-off from the construction site.
- B. The contractor, under this construction contract, is responsible for implementation and maintenance of all pollution control methods required in this specification section. The contractor is to perform all work, in the owner's interest, required by ADEQ to control storm water run-off from the construction site.

1.02 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
 - 1. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
 - 2. Restoration of areas eroded due to insufficient preventive measures.
- B. Compensation of the Owner for fines levied by authorities having jurisdiction due to non-compliance or inadequate compliance by Contractor.
- C. Arkansas Department of Environmental Quality (ADEQ) Requirements:
 - 1. Post on-site Storm Water Construction Notice
 - 2. Develop Storm Water Pollution Prevention Plan (SWPPP).
 - 3. Use best management practices to reduce run-off.
 - 4. Inspect SW controls bi-monthly

1.03 SWWP PLAN

- A. Refer to the Civil drawings.

1.04 PERFORMANCE REQUIREMENTS

- A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control.
- B. Also comply with all more stringent requirements of State of Arkansas Erosion and Sedimentation Control Manual.
- C. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
- D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
 - 1. Obtain and pay for permits and provide security required by authority having jurisdiction.
 - 2. Owner will withhold payment to Contractor to all fines resulting from non-compliance with applicable regulations.
- E. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- F. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
- G. Erosion On-Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
 - 1. Control movement of sediment and soil from temporary stockpiles of soil.
 - 2. Prevent development of ruts due to equipment and vehicular traffic.
 - 3. If erosion occurs due to work associated with this project, restore eroded areas at no cost to the Owner.

- H. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
 - 1. Prevent windblown soil from leaving the project site.
 - 2. Prevent tracking of mud onto public roads outside site.
 - 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 - 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to the Owner.
- I. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to the Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 - 2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
- J. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to the Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- K. Open Water: Prevent standing water that could become stagnant.
- L. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mulch: Use one or more of the following:
 - 1. Straw or hay.
 - 2. Erosion control matting or netting.
- B. Grass Seed For Temporary Cover. Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.
- C. Bales: Air dry, rectangular straw bales.
 - 1. Cross Section: 14 by 18 inches, minimum.
 - 2. Bindings: Wire or string, around long dimension.
- D. Bale Stakes: One of the following, minimum 3 feet long:
 - 1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
 - 2. Wood, 2 by 2 inches in cross section.
- E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
 - 1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM 04751.
 - 2. Permittivity: 0.05 secA-1, minimum, when tested in accordance with ASTM D4491.
 - 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355 after 500 hours exposure.
 - 4. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D4632.
 - 5. Elongation: 15 to 30 percent, when tested in accordance with ASTM 04632.
 - 6. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D4533.
 - 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

8. Provide wire mesh silt fence backup as detailed on drawings.
- F. Silt Fence Posts: One of the following, minimum 5 feet long:
 1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
 2. Hardwood, 2 by 2 inches in cross section.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Construction Entrances: Traffic-bearing aggregate surface.
 1. Width: As required; 20 feet, minimum.
 2. Length: 50 feet, minimum.
 3. Provide at each construction entrance from public right-of-way.
 4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
- C. Linear Sediment Barriers: Made of silt fences.
 1. Provide linear sediment barriers:
 - a. Along downhill perimeter edge of disturbed areas, including soil stock piles.
 - b. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart.
 2. Space sediment barriers with the following maximum slope length upslope from barrier:

a. Slope of Less Than 2 Percent:	100 feet..
b. Slope Between 2 and 5 Percent:	75 feet.
c. Slope Between 5 and 10 Percent:	50 feet.
d. Slope Between 10 and 20 Percent:	25 feet.
e. Slope Over 20 Percent:	15 feet.
- D. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
- E. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.
- F. Soil Stockpiles: Protect using one of the following measures:
 1. Cover with polyethylene film, secured by placing soil on outer edges.
 2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.
- G. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
- H. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

- A. Silt Fences:
 1. Store and handle fabric in accordance with ASTM 04873.
 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.

4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
 5. Install with top of fabric at nominal height and embedment as specified.
 6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
 7. Fasten fabric to wood posts using one of the following:
 8. Four 3/4 inch diameter, 1 inch long, 14 gage nails.
 9. Five 17-gage staples with 3/4 inch wide crown and 1/2 inch legs.
 10. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
 11. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.
- B. Straw Bale Rows:
1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
 2. Install bales so that bindings are not in contact with the ground.
 3. Embed bales at least 4 inches in the ground.
 4. Anchor bales with at least two stakes per bale, driven at least 18 inches into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
 5. Fill gaps between ends of bales with loose straw wedged tightly.
 6. Place soil excavated for trench against bales on the upslope side of the row, compacted.
- C. Temporary Seeding:
1. When hydraulic seeder is used, seedbed preparation is not required.
 2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
 3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
 4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.
 5. Incorporate fertilizer into soil before seeding.
 6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.
 7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
 8. Repeat irrigation as required until grass is established.

3.05 MAINTENANCE

- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately.
- C. Silt Fences:
 1. Promptly replace fabric that deteriorates unless need for fence has passed.
 2. Remove silt deposits that exceed one-third of the height of the fence.
 3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- D. Straw Bale Rows:
 1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
 2. Remove silt deposits that exceed one-half of the height of the bales.
 3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- E. Clean out temporary sediment control structures weekly and relocate soil on site.
- F. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by the Architect.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

SECTION 01 5813
TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project identification sign.
- B. Project informational signs.

1.02 QUALITY ASSURANCE

- A. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.
- B. Sign Painter: Experienced as a professional sign painter for minimum three years.
- C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

- A. Structure and Framing: New, treated wood or metal, structurally adequate.

2.02 PROJECT IDENTIFICATION SIGN

- A. Refer to the ACEDP Bid Package for design requirements.

2.03 PROJECT INFORMATIONAL SIGNS

- A. Provide at each field office, storage shed, and directional signs to direct traffic into and within site. Relocate as Work progress requires.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install project identification sign within 30 days after date fixed by Notice to Proceed or as indicated in ACEDP Bid Package.
- B. Erect at location of high public visibility adjacent to main entrance to site - coordinate with the Architect.
- C. Install sign surface plumb and level, with butt joints. Anchor securely.

3.02 MAINTENANCE

- A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

- A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION

**SECTION 01 6000
PRODUCT REQUIREMENTS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations and procedures.
- F. Procedures for Owner-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 15 days after date of Agreement.
 - 2. For products specified only by reference standards, list applicable reference standards.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
- E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

PART 2 PRODUCTS**2.01 EXISTING PRODUCTS**

- A. In general, do not use materials and equipment removed from owner's existing facility unless specifically required or permitted by the Contract Documents.
 - 1. The owner's generator from the existing facility shall be relocated and installed under the general contractor's scope of work. Equipment to be relocated shall include generator, transfer switch (if new is not specified) along with all other associated components required for operation.
- B. Unforeseen historic items encountered remain the property of the Owner; notify the Owner promptly upon discovery; protect, remove, handle, and store as directed by the Owner.
- C. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents. Do not use products from other projects or from Contractor's stockpile.
- B. Do not use products having any of the following characteristics:
 - 1. Made using or containing CFC's or HCFC's.
- C. Urea-Formaldehyde Prohibition:

1. Overall Project Requirement: Provide composite wood and agri-fiber products having no added urea-formaldehyde resins.
 2. Require each installer to certify compliance and submit product data showing product content.
 3. Specific Product Categories: Comply with limitations specified elsewhere.
- D. Provide interchangeable components of the same manufacture for components being replaced.
- E. Motors: Refer to Section 15065, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.
- F. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
- G. Cord and Plug: Provide minimum 6 foot (2 m) cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- C. A request for substitution constitutes a representation that the submitter:
 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 2. Will provide the same warranty for the substitution as for the specified product.
 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to the Owner.
 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- D. Substitution Submittal Procedure:
 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
 3. The Architect will notify in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

- A. See Section 01100 - Summary for identification of Owner-supplied products.
- B. Owner's Responsibilities:
 1. Arrange and pay for product delivery to site.
 2. On delivery, inspect products jointly with the contractor.

3. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 4. Arrange for manufacturers' warranties, inspections, and service.
- C. Contractor's Responsibilities:
1. Review Owner reviewed shop drawings, product data, and samples.
 2. Receive and unload products at site; inspect for completeness or damage jointly with the Owner.
 3. Handle, store, install and finish products.
 4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

- A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- B. Transport and handle products in accordance with manufacturer's instructions.
- C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- H. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 6160

VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. VOC restrictions for product categories listed below under "DEFINITIONS."
- B. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

1.02 DEFINITIONS

- A. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:
 - 1. Adhesives, sealants, and sealer coatings.
 - 2. Carpet.
 - 3. Carpet cushion.
 - 4. Carpet tile.
 - 5. Resilient floor coverings.
 - 6. Wood flooring.
 - 7. Paints and coatings.
 - 8. Insulation.
 - 9. Gypsum board.
 - 10. Acoustical ceilings and panels.
 - 11. Cabinet work.
- B. Interior of Building: Anywhere inside the exterior weather barrier.
- C. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- D. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Evidence of Compliance: Submit for each different product in each applicable category.
- C. Product Data: For each VOC-restricted product used in the project, submit product data showing compliance, except when another type of evidence of compliance is required.
- D. Installer Certifications for Accessory Materials: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of his products, or 2) that such products used comply with these requirements.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Adhesives and Joint Sealants: Provide only products having volatile organic compound (VOC) content not greater than required by South Coast Air Quality Management District Rule No.1168.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
- B. Aerosol Adhesives: Provide only products having volatile organic compound (VOC) content not greater than required by GreenSeal GS-36.

1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current GreenSeal Certification.
- C. Paints and Coatings: Provide products having VOC content as specified in Section 09900.
- D. Carpet and Adhesive: Provide products having VOC content not greater than that required for CRI Green Label Plus certification.
 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current Green Label Plus Certification.
 - b. Report of laboratory testing performed in accordance with requirements.
- E. Carpet Tile and Adhesive: Provide products having VOC content not greater than that required for CRI Green Label Plus certification.
 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current Green Label Plus Certification.
 - b. Report of laboratory testing performed in accordance with requirements.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. The Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to the owner.
- B. All additional costs to restore indoor air quality due to installation of non-compliant products will be borne by.

END OF SECTION

**SECTION 01 7000
EXECUTION REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Cutting and patching.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of the Owner's personnel.
- H. Closeout procedures, except payment procedures.
- I. General requirements for maintenance service.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration of work in-place that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
 - 6. Include in request:
 - a. Identification of Project.
 - b. Location and description of affected work.
 - c. Necessity for cutting or alteration.
 - d. Description of proposed work and products to be used.
 - e. Alternatives to cutting and patching.
 - f. Effect on work of Owner or separate Contractor..
 - g. Written permission of affected separate Contractor.
 - h. Date and time work will be executed.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.03 QUALIFICATIONS

- A. For demolition work, employ a firm specializing in the type of work required.
- B. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Jonesboro, Arkansas.
- C. For survey work, employ a land surveyor registered in Arkansas and acceptable to the Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.
- D. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Arkansas.

1.04 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
 - 2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Minimize amount of bare soil exposed at one time.
 - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
 - 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
- H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.05 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner's occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS - NOT USED**PART 3 EXECUTION****3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Examine and verify specific conditions described in individual specification sections.
- C. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- D. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a pre-installation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Matt Silas Architect two days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Matt Silas Architect, the Owner, participants, and those affected by decisions made.

3.03 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Matt Silas Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Matt Silas Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Matt Silas Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, and ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

3.04 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-conforming work.
- C. Execute cutting and patching to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.
- J. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
- K. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

3.06 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.07 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.

- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.08 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Matt Silas Architect and owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.09 DEMONSTRATION AND INSTRUCTION

- A. See Section 018200 - Demonstration and Training.

3.10 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.11 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
 - 1. Clean areas to be occupied by the Owner prior to final completion before occupancy.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces,
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.12 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Matt Silas Architect.
- B. Notify Matt Silas Architect when work is considered ready for Substantial Completion.

- C. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Matt Silas Architect's review.
- D. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to owner-occupied areas.
- E. Notify Matt Silas Architect when work is considered finally complete.
- F. Complete items of work determined by Matt Silas Architect's final inspection.

3.13 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Furnish service and maintenance of components indicated in specification sections during the warranty period.
- D. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- E. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- F. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings..

3.02 OPERATION AND MAINTENANCE DATA

- A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 1. Product data, with catalog number, size, composition, and color and texture designations.
 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 1. Description of unit or system, and component parts.
 2. Identify function, normal operating characteristics, and limiting conditions.
 3. Include performance curves, with engineering data and tests.
 4. Complete nomenclature and model number of replaceable parts.
- B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- B. Prepare data in the form of an instructional manual.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- H. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
 - 1. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
- I. Part 1: Directory, listing names, addresses, and telephone numbers of the Architect, Contractor, Subcontractors, and major equipment suppliers.
- J. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - 1. Significant design criteria.
 - 2. List of equipment.
 - 3. Parts list for each component.
 - 4. Operating instructions.
 - 5. Maintenance instructions for equipment and systems.
 - 6. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
- K. Part 3: Project documents and certificates, including the following:
 - 1. Shop drawings and product data.
 - 2. Air and water balance reports.
 - 3. Certificates.
 - 4. Photocopies of warranties and bonds.
- L. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.
- M. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of the Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with the Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

**SECTION 01 8200
DEMONSTRATION AND TRAINING**

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of the Owner's personnel in operation and maintenance is required for:
 - 1. HVAC systems and equipment.
 - 2. Plumbing equipment.
 - 3. Electrical systems and equipment.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Training Plan: The Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Matt Silas Architect for transmittal to the Owner.
 - 2. Submit not less than four weeks prior to start of training.
 - 3. Revise and resubmit until acceptable.
 - 4. Provide an overall schedule showing all training sessions.
 - 5. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such a slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.03 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by the Owner.
- B. Demonstration may be combined with the Owner's personnel training if applicable.

- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Provide training in minimum two hour segments or adequate time allotment relative to complexity of equipment operations.
- C. Training schedule will be subject to availability of the Owner's personnel to be trained; re-schedule training sessions as required by the Owner; once schedule has been approved by owner's failure to conduct sessions according to schedule will be cause for the Owner to charge for personnel "show-up" time.
- D. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 - 3. Typical uses of the O&M manuals.
- E. Product- and System-Specific Training:
 - 1. Review the applicable O&M manuals.
 - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 - 6. Discuss common troubleshooting problems and solutions.
 - 7. Discuss any peculiarities of equipment installation or operation.
 - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 - 10. Review spare parts and tools required to be furnished by.
 - 11. Review spare parts suppliers and sources and procurement procedures.
- F. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 03 0516
UNDERSLAB VAPOR BARRIER**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Sheet vapor barrier under concrete slabs on grade.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.03 REFERENCE STANDARDS

- A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011 (Reapproved 2017).
- B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products.
- C. Samples: Submit samples of underslab vapor barrier to be used.
- D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Underslab Vapor Barrier:
 - 1. Water Vapor Permeance: Not more than 0.010 perms (0.6 ng/(s m² Pa)), maximum.
 - 2. Thickness: 15 mils (0.4 mm).
 - 3. Basis of Design:
 - a. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil):
www.stegoindustries.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.
- B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.
- C. Lap joints minimum 6 inches (150 mm).
- D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
- E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.
- F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

SECTION 03 1000
CONCRETE FORMING AND ACCESSORIES**PART 1 GENERAL****1.01 SECTION INCLUDES**

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

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. See Structural documents for other requirements.

1.03 REFERENCE STANDARDS

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- B. ACI 301 - Specifications for Structural Concrete; 2016.
- C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2017).
- D. ACI 347R - Guide to Formwork for Concrete; 2014.
- E. PS 1 - Structural Plywood; 2009.

1.04 QUALITY ASSURANCE

- A. Perform work of this section in accordance with Highways standards of the State of Arkansas.
- B. Designer Qualifications: Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in ARKANSAS.

PART 2 PRODUCTS**2.01 FORMWORK - GENERAL**

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

2.02 WOOD FORM MATERIALS

- A. Softwood Plywood: PS 1, C Grade, Group 2.

2.03 REMOVABLE PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gauge, 0.0598 inch (1.52 mm) thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

2.04 FORMWORK ACCESSORIES

- A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, 3/4" inch back break dimension, (18 mm back break dimension,) free of defects that could leave holes larger than 1 inch (25 mm) in concrete surface.
- B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

- 1. Composition: Colorless, reactive, water-based or solvent-based compound.
- C. Dovetail Anchor Slot: Galvanized steel, at least 22 gage, 0.0299 inch (0.76 mm) thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- E. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 1200.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 EARTH FORMS

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

3.03 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members that are not indicated on drawings.
- F. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.04 APPLICATION - FORM RELEASE AGENT

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

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Position recessed anchor slots for brick veneer masonry anchors to spacing and intervals specified in Section 04 2001.
- E. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

3.06 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.

3.07 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

3.08 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

3.09 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

**SECTION 03 2000
CONCRETE REINFORCING****PART 1 GENERAL****1.01 SECTION INCLUDES**

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

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Structural Concrete; 2016.
- B. ACI SP-66 - ACI Detailing Manual; 2004.
- C. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement; 2017.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.
- F. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.
- G. CRSI (DA4) - Manual of Standard Practice; 2009.
- H. CRSI (P1) - Placing Reinforcing Bars; 2011.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
 - 1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in ARKANSAS.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301.

PART 2 PRODUCTS**2.01 REINFORCEMENT**

- A. Refer to structural documents for reinforcement requirements.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
 - 1. Deformed billet-steel bars.
- C. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.
 - 1. Form: Flat Sheets.
 - 2. WWR Style: As indicated on drawings.
- D. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.02 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
- B. Welding of reinforcement is permitted only with the specific approval of Architect. Perform welding in accordance with AWS D1.4/D1.4M.

1. Galvanized Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI (DA4).

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing as follows:
 1. Per structural documents.
- E. Comply with applicable code for concrete cover over reinforcement.

3.02 SCHEDULES

- A. Reinforcement For Superstructure Framing Members: Deformed bars, unfinished.
- B. Reinforcement For Foundation Wall Framing Members and Slab-on-Grade: Deformed bars and welded wire reinforcement, galvanized finish.

END OF SECTION

SECTION 03 3000
CAST-IN-PLACE CONCRETE**PART 1 GENERAL****1.01 SCOPE OF WORK:**

- A. Furnishing of and paying for all labor, materials, services, equipment and appliances required for execution, installation, and completion of all work specified herein and/or shown on the drawings.
- B. Section Includes:
 - 1. Cast-in-place (CIP) concrete in building, floors, foundations, foundation walls, supported slabs, slabs-on-grade or fill on vapor barrier.
 - 2. Formwork for CIP concrete, with shoring, bracing, anchorage, openings for other affected work, form accessories, and stripping forms.
 - 3. Reinforcing steel bars, welded steel wire fabric, fabricated steel bar or rod mats for CIP concrete. Support chairs, bolsters, bar supports, spacers, and other accessories for supporting reinforcement.
 - 4. Finishing of concrete floor slabs.
 - 5. Expansion and contraction, control joints in CIP concrete.
 - 6. Concrete curing and protection.
 - 7. Non-shrink grout including installation and forming.
 - 8. Vapor Barrier under concrete slabs-on-grade.
 - 9. Install all Division 15 & 16 concrete equipment pads as shown on the drawings and specified in their specific section of specification.
- C. Work installed but furnished under other sections:
 - 1. Install only, in accord with drawings provided, all embedded-type reglets, sleeves, anchors, and/or other devices for use in other sections of these specifications. Drawings and devices will be provided by using sections, showing proper location and installation. See Section 013000.

1.02 RELATED SECTIONS:

- A. Section 010100 - Summary of Work.
- B. Section 014000 - Quality Control.
- C. Section 025200 - Exterior Sitework Concrete
- D. Section 076200 - Sheet Metal Flashing and Trim
- E. Section 096600 - Resilient Flooring and Base
- F. Section 099000 - Painting

1.03 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 - "General Requirements," apply to work of this section.
- B. Use this specification in conjunction with the General Notes and specific directives on the Contract Structural Drawings.
- C. Perform work in accordance with ACI 301 except as modified herein. Keep a copy at the project site.

1.04 REFERENCE:

- A. All CIP concrete work shall conform to the American Concrete Institute "Specifications for Structural Concrete for Buildings" ACI 301 including reference standards in Section 1.4 thereof except as modified by requirements specified herein or as noted on the Structural Drawings.
- B. A copy of ACI SP-15 "Field Reference Manual" which includes ACI 301 and reference standards specified therein shall be kept at the job site for ready reference.
- C. ACI 318 Building Code Requirements for Reinf. Concrete

- D. ACI 117 Standard: "Standard Tolerances for Concrete Construction and Materials" except as modified by requirements specified herein.
- E. ACI Manual of Concrete Practice and included reference standards noted herein.
- F. ASTM Standards noted in ACI 301 or noted herein - current edition.
- G. ACI Manual of Concrete Inspection (ACI 311.1R).
- H. CRSI MSP-2: "Manual of Standard Practice", CRSI 63 Recommended Practice for placing reinforcing bars, and CRSI 65 Recommended Practice for placing bar supports.
- I. ANSI/AWS D1.4 Structural Welding Code Reinforcing Steel.
- J. ACI 347 Recommended Practice for Concrete Formwork.
- K. PS - 1 - Construction and Industrial Plywood.
- L. National Ready Mix Concrete Association, QC Method - Plant Certification.

1.05 SUBMITTALS:

- A. Submit under provisions of Section 013000.
- B. Shop Drawings: Submit shop drawings for cast-in-place concrete shown on structural drawings including:
 - 1. Rebar placing drawings (ACI 315, Detailing Manual SP-66): Show bar sizes, spacing, locations, and quantities of reinforcing steel and wire fabric and supporting and spacing accessories.
- C. Product Data: Provide data on joint devices, attachment accessories, admixtures and vapor barrier.
- D. Manufacturer's Installation Instructions: Provide manufacturer's specifications, recommendations, and/or directions are referred to in the specifications.
- E. Manufacturer's Certificate: Contractor shall submit signed certificate from the suppliers of materials and manufactured items certifying that such materials and manufactured items conform to the requirements set forth in the specification.

1.06 PROJECT RECORD DOCUMENTS:

- A. Submit under provision of Section 017200.
- B. Submittals
- C. Certifications
- D. Test Reports

1.07 QUALITY ASSURANCE:

- A. It is the responsibility of the Contractor to maintain an adequate program of quality control for the materials, production methods, and workmanship to assure conformance of all work to the project contract documents.
- B. All materials, equipment, and methods shall be subject to verification inspections and/or testing by the Owner's agents as specified herein.
- C. Engineering verification: Periodic construction review of the cast-in-place, reinforced concrete will be performed by Tom Robison & Associates, Inc., Consulting Structural Engineers, upon request by the Architect or Contractor.
- D. Testing Laboratory Services:
 - 1. The Testing Laboratory specified in Section 014100 shall have prime responsibility for review, verification inspection, and/or testing of the concrete producer's materials, operations, facilities, and quality control procedures for conformance with these specifications until the mixed concrete is discharged from the mixer or truck at the project site.

2. Concrete testing services are supplementary adjuncts to the Engineering Verification Inspections and will be provided by an independent testing laboratory conforming to ASTM E329 in accordance with Section 014100 and ACI 301.
 3. The Testing Laboratory will be required to provide evidence of recent inspection of its facilities by the Cement and Concrete Reference Laboratory of the National Bureau of Standards (NBS) and to show that any deficiencies have been corrected.
 4. In addition to the requirements and duties in ACI 301, comply with the following provisions:
 - a. One or more additional test cylinders than required in ACI 301 are to be taken during cold weather concreting and cured on the job site under conditions of concrete represented to determine safe form-stripping period.
 - b. Sample (and test when directed) each shipment of cement and aggregates and verify approved admixtures. Store samples in a protected place until authorized to dispose of them. (See 2.2 herein.)
 - c. Inspect concrete batching, mixing, and delivery operations periodically or as directed.
 - d. Review Manufacturer's reports and/or certification for each shipment of cement and reinforcing steel and/or conduct laboratory tests or spot checks of the materials as received for compliance with specifications.
 - e. Submit to the Engineer, Concrete Producer, Contractor, and Owner during construction, the results of concrete tests conducted by an independent testing agency. Include the following information:
 - 1) Weight of concrete - ASTM C138
 - 2) Slump - ASTM C143
 - 3) Air content of freshly-mixed concrete by the pressure method, ASTM C231 or the volumetric method, ASTM C173
 - 4) Concrete temperature (at placement time).
 - 5) Air temperature (at placement time).
 - 6) Strength determined in accordance with ASTM C39.
 - f. Other testing or inspection as required.
 5. Field inspections are to be made by a competent representative of the Testing Laboratory during all structural concreting operations including periodic audit and spot check of the Producer's and/or Contractor's quality control procedures to assure proper and adequate control. When it appears that any material furnished fails to fulfill specification requirements, the Testing Laboratory is to report such deficiency immediately to the Architect/Engineer and Contractor and appropriately record it in his report.
 6. Authority and duties of Testing Laboratory: Refer to Section 014100 and ACI 301.
 7. Responsibilities and duties of Contractor: ACI 301. To facilitate testing services, the Contractor shall:
 - a. Secure and deliver, at his expense, preliminary representative samples of the materials he proposes to use and which are required to be tested.
 - b. Submit the concrete mix design(s) he proposes to use and make written request for approval.
 - c. Furnish labor as is necessary to obtain and handle samples at the project or at other sources of material.
 - d. Advise the Testing Laboratory sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.
 - e. Provide and maintain for the sole use of the Testing Laboratory adequate facilities for safe storage and proper curing of concrete test cylinders on the project site for the first 24 hours as required by ASTM C31.
 - f. Furnish copies of Mill Test Reports of all shipments of cement and reinforcing steel to the Architect/Engineer and the Testing Laboratory.
- E. Enforcement of strength and/or physical requirements: Concrete compression strength test results are to be evaluated in accordance with ACI 214 and ACI 301. Should the average strength determined by the control cylinders fall below the required strength, the necessary changes in the design mix shall be made in accordance with ACI 301. Should the strength indicated by the field test cylinders fall below nominal strength, additional curing of those

portions represented will be required. In the event that such additional curing will not give the strength required or in other cases where, due to faulty workmanship, the strength is in doubt, load tests conforming to ACI 318 or core samples (ASTM C42) will be required as appropriate to determine the adequacy of the members in question. Should these tests show that the strength of the concrete is inadequate, strengthening of replacement will be required. Where air entrainment is in question, check by ASTM C457 (Linear Traverse Method). All of the above requirements are to be fulfilled at the Contractor's expense.

F. Tolerances: ACI 117

PART 2 PRODUCTS

2.01 GENERAL:

A. See General Notes on structural drawings for specific requirements (i.e., type concrete and reinforcing, design assumptions, formwork and flat work finishes, tolerances, etc.). Otherwise, conform to ACI 301 except as herein modified. All materials are to be sampled and pretested or certified by the Manufacturer and approved before use.

2.02 CONCRETE MATERIALS:

A. Cements: ACI 301

1. Portland Cement: ASTM C150 - Type I unless otherwise approved.
2. The Contractor shall assume full responsibility for the quality and soundness of cement. Cement is to be of one type and from the same mill.
3. Where appropriate, the Manufacturer's Mill Test Reports may be accepted as certification of pretesting of cement to be used. Where the delivery methods make it impractical to pretest and/or maintain proper identity of the tested cement, pretesting may be waived; in which case, samples are to be taken of all shipments of cement used and retained by the testing lab for a period of one year. Such samples are to be tested as directed.

B. Admixtures: ACI 301 and ACI 212.2R - The following admixtures are permitted when approved in writing prior to use (or required as specified herein) and are to be used in strict accordance with the Manufacturer's specifications or recommendations:

1. Calcium chloride: Calcium Chloride shall not be used as an admixture in the concrete.
2. Air-entraining admixtures: ASTM C260 shall be used to achieve the specified air content in all permanently exposed exterior concrete. (See ACI 301.) Hardened concrete shall have an air void spacing factor of 0.0080 in. maximum; the number of air voids/in. shall be 1-1/2 to 2 times the numerical value of the Entrained Air Content percentage, as determined by ASTM C457.
3. Water-reducing admixtures: ASTM C494, Type A containing not more than 1% chloride ions.
4. Water-reducing/accelerating admixtures: ASTM C494, Type C or E having long-term test results showing non-rusting on metal deck and reinforcing steel shall be used in all concrete placed at air temperature below 50 degrees F.
5. Water-reducing/retarding admixtures: ASTM C494, Type D containing not more than 1% chloride ions shall be used when concrete is placed in an ambient temperature over 80 degrees F.
6. High-range/water-reducing (HRWR) admixtures: ASTM C494, Type F or G super plasticizers containing 1% maximum Chloride ions may be used with low slump (3" maximum) concrete to produce flowable concrete (up to 8" slump) with early strength gain and 28-day strengths equal to reference concrete. HRWR admixture may be used providing not more than 60 minutes is allowed from addition of admixture shall be used in concrete with a maximum water/cement ratio of 0.50.
 - a. Where more than 30 minutes is required between the addition of admixtures to final placement of the concrete, a combination of water-reducing, set controlling admixtures (ASTM C494, Types A,D, & E) as in Master Builders Company "Synergized Performance System" may be used.
7. Fly ash - ASTM C618: The use of a quality fly ash will be permitted as a cement-reducing admixture (maximum 20%). The fly ash shall meet all of the requirements of ASTM C618,

Class C (Class F will not be allowed), with the following special requirements: The loss on ignition in Table 1 shall not exceed 3%. Compliance to Table 1A shall apply. The amount retained on the 325 sieve in Table 2 shall not exceed 20%. The chemical analysis of the fly ash shall be reported in accordance with ASTM C114. Quality assurance testing and reports for a minimum of six (6) months shall be submitted by the fly ash supplier. The option to use fly ash must be approved prior to use.

a. Fly ash shall not be used for polished concrete systems.

- C. Aggregates: ACI 301, Section 2.4 and ACI 221R
 - 1. Normal-weight concrete - ASTM C33
 - 2. Lightweight concrete - ASTM C330.
 - 3. All concrete exposed to the weather shall be: crushed limestone, Class Designation 5S.
 - 4. Maximum size of coarse aggregates: ACI 301.
- D. Water: ACI 301, Section 2.3, potable
- E. Non-Shrink Grout: Factory premixed grout containing nonmetallic aggregates or mineral aggregates and requiring only addition of water at the site. "Euco NS" (non-metallic) by The Euclid Chemical Company, or "masterflow 713" (non-metallic) by Master Builders. The grout shall conform to CRD-621, "Corps of Engineers Specifications for Non-Shrink Grout". Use of non shrink grout when exposed to weather shall not be permitted unless certified by the supplier that it will not damage surrounding concrete.
- F. Liquid membrane-forming compounds for curing concrete - ASTM C309, Type 1, Class A or Federal Specification TT-C-800 Type 1 (Curing compound shall be compatible with floor sealer or finish specified).
- G. Moisture-retaining cover: Complying with ASTM C171, waterproof, heavy kraft paper, polyethylene film (min. 6 mils thick), or polyethylene-coated burlap.
- H. Curing and sealing: ACI 301 and Federal Specification TT-C-800, Type I - Chlorinated rubber or styrene-butadiene-based compounds with 30% solids content minimum and having moisture retention tests by an independent testing laboratory showing a maximum moisture loss of 0.03 gm/cm at a coverage of 300 s.f. per gallon.
 - 1. Method of curing and curing products is to be reviewed by the polished concrete, flooring applicator. Notify the Architect if proposed curing compounds are not suitable with liquid-applied products used by flooring applicator.
- I. Bonding compound: Polyvinyl acetate, rewettable type
 - 1. "EucoWeld" - The Euclid Chemical Company
- J. Epoxy adhesive: 100% solids, to component material suitable for use on dry damp surfaces
 - 1. "Euco Epoxy" - The Euclid Chemical Company
- K. Joint filler:
 - 1. Slabs and curbs: Asphalt-impregnated fiberboard
 - a. "Flexcell" - Celotex Corporation
 - b. "Fibre Expansion Joint" - W.R. Meadows, Inc.
 - 2. Joint filler used vertically to isolate walls from columns and other walls: White molded polystyrene beadboard type.
- L. Dry-packaged mixtures: ASTM C387
- M. Preformed expansion joint material conforming to ASTM D1751 Of the asphalt impregnated type such as Flexcell as manufactured by Coltex.
- N. Storage of materials: ACI 301
- O. Certification: Certification of the above requirements is required from the admixture manufacturer prior to mix design review and approval by the Engineer. Upon request of the Architect/Engineer, a qualified representative is to be provided to assure proper use of admixtures. Use of admixtures, other than listed above will be permitted only when approved prior to bidding.

2.03 PROPORTIONING: ACI 301

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method is used, use an independent testing facility acceptable to Architect/Engineer for preparing and reporting proposed mix designs.
- B. Submit written reports of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and approved. Include the following information for each concrete mix design:
 - 1. Method used to determine the proposed mix design
 - 2. Gradation of fine and coarse aggregates
 - 3. Proportions of all ingredients including all admixtures added either at the time of batching or at the job site.
 - 4. Water-cement ratio
 - 5. Slump, ASTM C143
 - 6. Certification of the chloride content of admixtures
 - 7. Air Content:
 - a. Of freshly-mixed concrete by microscopic determination, ASTM C457, (Linear Traverse Method)
 - 8. Unit Weight of concrete, ASTM C138
 - 9. Strength at 4, 7, and 28 days, ASTM C39
 - 10. Method of recording batch proportions
- C. Concrete Types and Strengths: See General Notes on structural drawings and ACI 301.
- D. Weights: All concrete shall be normal-weight concrete, unless noted otherwise on structural drawings.
- E. Durability: ACI 301 and ACI 201 - All concrete exposed to potentially destructive weathering, such as freezing and thawing, or to de-icer chemicals is to be air-entrained, 6%+1%, compressive strength as indicated, 4" max. slump, and shall have crushed limestone aggregates. All concrete in designated areas shall conform to the recommendations of ACI 201.
- F. Slump: ACI 301.
 - 1. 4" maximum for consolidation by vibration
 - 2. 5" maximum for consolidation by other methods
 - 3. 8" maximum for flowable concrete. Concrete containing HRWR admixture (super plasticizer): 3" maximum before addition of HRWR
 - 4. Where field conditions require slump to exceed that specified above, the increased slump shall be obtained by the use of a superplasticizer only, and the Contractor shall obtain written approval from the Engineer who may require an adjustment to the mix.
- G. Selection of proportions (mix design): ACI 301 and ACI 211.1.
 - 1. Water-cement ratio: For concrete subject to freezing and thawing or deicer chemicals, the water-cement ratio shall not exceed 0.45 by weight including any water added to meet specified slump in accordance with the requirements of ASTM C94 unless otherwise noted.
- H. Production of concrete: (ACI 301)
 - 1. Ready-mixed concrete:
 - a. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94.
 - b. All concrete shall be proportioned conforming to the approved mix designs and of the materials contained in those approved mixes. A certified copy of the design weights for each mix shall be kept at the producing plant for each class of concrete used on the project.
 - c. Plant equipment and facilities are to conform to the "Check List for Certification of Ready-Mixed Concrete Production Facilities" of the National Ready-Mixed concrete

Association and have NRMCA or approved certification within the past year. No switching of plants will be permitted without prior approval.

- d. Each automatic batching plant shall:
 - 1) be equipped with an approved accurate recorder which will provide a permanent and continuous record of batching operations, or
 - 2) An independent testing laboratory approved by the Engineer shall be employed by the Contractor to observe and record all concrete batched at the plant.
- 2. All other concrete: ACI 301.
- 3. Concrete produced by on-site volumetric batching and continuous mixing shall conform to ASTM C685.
- 4. Use of accelerating admixtures in cold weather and retarding admixtures in hot weather shall not relax placement requirements specified herein.
- 5. Admixtures: ACI 301 and 2.0.2B above. All concrete placed at ambient temperatures below 50 degrees F. is to contain a specified accelerator. All concrete placed at ambient temperatures above 80 degrees F. is to contain a specified retarder. All concrete required to be air-entrained is to contain an approved air-entraining admixture. When improved workability, pumpability, lower water-cement ratio, or high ultimate and/or early strength is required, the HRWR admixture (super plasticizer) may be used.
- 6. The concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around reinforcement without permitting materials to segregate or free water to collect on the surfaces. Within the limiting requirements, the Contractor shall adjust the consistency of the concrete as may be necessary to produce mixtures which will be placeable with reasonable methods of placing and compacting. The Contractor shall maintain on the job at all times adequate extra cement to be used at rate of ½ sack cement per cubic yard concrete for each 2" slump increase for corrections due to wetness desired or obtained. No water shall be added to concrete except under the direct supervision of the laboratory inspector.
- 7. Adjustments to concrete mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant at no additional cost to Owner. Laboratory test data for revised mix design and strength results must be submitted and accepted before using in work.
- 8. The chloride ion content of reinforced concrete in a moist environment and exposed to chloride deicing salts shall not exceed 1.0% by weight of the concrete.

2.04 FORMWORK: ACI 301 AND ACI 347 - RECOMMENDED PRACTICE FOR CONCRETE FORMWORK (SP-4)

- A. The design, construction, and removal of all formwork together with its safety and performance is the complete responsibility of the Contractor.
- B. Structural concrete: (Surfaces covered with other finishes - not exposed to view after completion of project)
 - 1. Wood form materials:
 - a. Plywood: Moisture-resistant, concrete form plywood commercial standard Exterior grade, edges sealed
 - b. Lumber: No. 2 dressed lumber: Southern yellow pine, white pine, or Douglas fir
 - c. Nails, spikes, lag bolts, thru bolts, ties, and anchorages: Sized as required and of sufficient strength and character to maintain formwork in place while pouring concrete
 - 2. Steel form deck: Corrugated steel forms (permanent) ASTM A446, Grade E, Coating Class G90.
 - 3. Tolerances: ACI 117
- C. Architectural Concrete: Surfaces permanently exposed to view are to conform to ACI 301 with finish as specified on the drawings and to ACI 303R Guide to Cast-In-Place Architectural Concrete Practice.
 - 1. Tolerances:
 - a. Variation of linear building lines: 1/4" maximum in 20 feet
 - b. Variation in cross-sectional dimensions: 1/8"

- c. Variation in surface tolerance: 1/8" in ten feet in any direction as determined by a ten-foot straightedge
 - d. Deflection of form facing material between supports: Not over 0.0025 times the span
- D. Formwork accessories:
- 1. Form ties: Removable or snap-off metal type with sufficient strength to support formwork and free of defects which will leave holes larger than 1" in concrete surface.
 - 2. Pre-formed construction joints: ACI 301.
 - 3. Expansion joints: ACI 301 - ASTM D994 and Division 5 of these specifications.
 - 4. Dovetail anchor slots, securable to concrete formwork: Equal to Heckman #100, 16-gauge steel, foam-filled, sealed slots with bent tab anchors to mate with ties.
 - 5. Flashing reglets: stainless or galvanized steel of sizes and at locations shown on drawings complete with alignment splines for joints and securable to concrete formwork.
 - 6. Wedge inserts: Equal to Heckman #425 in size and location shown on the drawings.
 - 7. Stud type expansion anchors shall be Hilti Kwik-Bolts as supplied by Hilti, Inc., Tulsa, OK.
 - 8. Other embeds as furnished by needing contractor. (See other specific sections of this specification).

2.05 REINFORCING MATERIALS: ACI 301

- A. Reinforcing bars (rebars): Grade 60, deformed (ASTM A615, A616, A617). Provide certification of "Carbon Equivalent" AWS D1.4 for all rebars to be welded.
- B. Welded wire mesh: ACI 301 - ASTM A185.
- C. Welding: ACI 301 and AWS D1.4
- D. Accessories: ACI 301 - As called for in the ACI Manual of Standard Practice for Detailing Concrete Structures (ACI 315), the CRSI Manual of Standard Practice (MSP-2), or other suitable types approved unless specifically shown otherwise on plans.
- E. Fabrication and placement tolerances: See ACI 117.

2.06 VAPOR BARRIER:

- A. Vapor barrier shall be placed beneath all concrete interior building slab-on-grade. Vapor barrier shall meet ASTM E 1745, Class A; certified by the manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.
 - 1. Acceptable product: See architectural specifications for make and thickness. Tape all joints and seal all penetrations.

2.07 WATER STOPS:

- A. Manufacturer: Greenstreak; St. Louis, MO.
 - 1. Other Acceptable Manufacturers:
 - a. W. R. Meadows, Inc.; Elgin, IL
 - b. Vinylex Corp.; Knoxville, TN.
- B. Material: PVC; provide factory made splices for other than straight butt joints.
- C. Style:
 - 1. Wall joints: #735, serrated with center bulb.
 - 2. Slabs to walls: #790, labyrinth.
 - 3. Construction joints at reinforcing interference: #790 labyrinth.

PART 3 EXECUTION

3.01 GENERAL

- A. Install all CIP concrete work in accordance with ACI 301 except as herein specified.

3.02 FORMWORK: ACI 301, CHAPTER 4 AND ACI 347

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

2. Design and construct formwork, shoring, and bracing to meet design and code requirements so that resultant finished concrete conforms to required shapes, lines, and dimensions and will safely support the wet concrete.
 3. Arrange and assemble formwork to permit dismantling and stripping so that concrete is not damaged during its removal.
 4. Align joints and make watertight to prevent leakage of mortar and disfigured appearance of concrete. Keep form joints to a minimum.
 5. When using earth forms, hand-trim sides and bottoms and remove loose dirt prior to placing concrete.
 6. Arrange forms to allow stripping without removal of principal shores where and when these are required to remain in place.
 7. Obtain Engineer's review before framing openings in structural elements which are not indicated on approved shop drawings.
 8. Provide bracing to ensure stability of formwork including provision for construction loads.
 9. Chamfer strips are to be provided as indicated on the architectural drawings.
 10. Tolerances: ACI 117
 11. Preparation of formed surfaces: ACI 301, Section 4.4
 - a. Where a finished surface is to be painted or covered, the materials applied to the formed surfaces are to be compatible with the type of covering to be used. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which may be affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.
 - b. Clean forms to remove foreign matter as erection proceeds. Remove cuttings, shavings, and debris from within forms. Flush with water or use compressed air to remove remaining foreign matter.
 - c. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms unless formwork and concrete construction proceeds within heated enclosure. Use compressed air or other means to remove foreign matter.
- B. Joints and Embedded items: ACI 301.
1. Installation of embedded items: Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.
 2. Coordinate work of other sections and cooperate with trade involved in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts. Do not perform work unless specifically indicated on approved shop drawings or as approved.
 3. Install concrete accessories in accordance with Manufacturer's recommendations and straight, level, and plumb. Ensure that items are not disturbed during concrete placement.
 4. Install water stops continuous without displacing reinforcement; seal joints watertight.
 5. Joint sealants: ACI 504
- C. Openings: The Contractor shall form all mechanical openings except pipe and sleeve inserts. Pipes and sleeves are to be set by the appropriate subcontractor responsible for that portion of the work as approved.
- D. Field quality control:
1. The Contractor is to inspect and check completed formwork shoring and bracing to ensure that work is in accordance with formwork design and that supports, fastenings, wedges, ties, and parts are secure before placing concrete.
 2. Inform Engineer when formwork is complete, has been cleaned, and is ready for inspection. Obtain review and approval prior to placing concrete.

3.03 REINFORCEMENT: ACI 301

- A. Placement: ACI 301.
1. Place reinforcing, supported and secured against displacement, as indicated on approved rebar placing drawings.

2. Reinforcing placement shall be inspected and approved by the Engineer before placement of concrete.
3. Welding: ACI 301 and AWS D1.4.
4. Provide 2" cover for all reinforcement in concrete which does not have a waterproofing membrane protection and is permanently exposed to earth or the elements.
5. Embedment, splices, & rebar development: ACI 408.1
6. Placement tolerances: ACI-117

3.04 CONCRETE:

- A. The Contractor shall have a responsible person available to receive and monitor concrete received from Ready-Mix supplier.
- B. Placement: ACI 301.
 1. Notify Engineer a minimum of 24 hours prior to commencement of concreting operations.
 2. Ensure that anchors, seats, plates, and other items to be cast into concrete are placed and held securely and will not cause hardship in placing concrete.
 3. Ensure that reinforcement, inserts, embedded parts, and formed expansion and contraction joints are not disturbed during concrete placement.
 4. At construction joints, prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding compound in accordance with Manufacturer's recommendations. Place new concrete immediately after the bonding compound has dried.
 5. Consolidation of concrete: ACI 309.
 6. Shotcrete: ACI 506.2.
- C. Depositing concrete: ACI 301& ACI 304
 1. Pour concrete continuously between predetermined approved construction and control joints. Do not break or interrupt successive pours such that cold joints occur.
 2. Conform to ACI 305 when concreting during hot weather.
 3. Conform to ACI 306 when concreting during cold weather.
 4. Maintain concrete cover around reinforcing as per Section 3.3. above and ACI 301.
 5. Pumping concrete: ACI 304.2.
 6. Belt conveying: ACI 304.4.
- D. Protection of cast concrete: ACI 301
- E. Repair of surface defects: ACI 301
 1. Allow Engineer to inspect concrete surfaces immediately upon removal of forms. Patch imperfections as needed or as directed.
 2. Modify or replace concrete not conforming to required lines, details, and elevations.
 3. Repair or replace concrete with excessive honeycombing and other defects due to improper placement. Do not patch, fill, touch-up, repair, or replace exposed architectural concrete except upon express direction of Architect/Engineer for each individual area.
 4. Tie holes shall be filled solid with patching mortar.
- F. Finishing of formed surfaces: ACI 301
 1. Tops of forms:
 - a. Strike concrete smooth at tops of forms.
 - b. Float to texture comparable to formed surfaces.
 2. Formed surfaces:
 - a. Permanently exposed surfaces or surfaces to be painted ACI 301 - Smooth Form Finish with the fins ground smooth and air holes or honeycomb filled with mortar.
 - b. Surfaces in unfinished areas unexposed to public view: ACI 301 - Rough Form Finish.
 - c. Exposed concrete surfaces not to be painted or coated but exposed to public view: ACI 301 - Smooth Rubbed Finish
- G. Slabs: ACI 301 and ACI 302.1 Guide for Concrete Floor and Slab Construction.
 1. Slabs-on-grade:

- a. Preparation of sub-grade (ACI 301). Provide vapor barrier below all slabs on grade typically.
 - b. Place floor slabs-on-grade by "strip cast" method. Contraction joints where shown on drawings shall be "Zip Strip" control joint former as manufactured by Greenstreak Plastic Products, installed in accord with the Manufacturer's recommendations.
 - c. Where indicated on the plans, separate slabs-on-grade from vertical surfaces with ½" - thick joint filler. Extend joint filler from bottom of slab to within 1/8" of finished slab surface.
 - d. Finishes: Trowled finish, ACI 301.
 - 1) Expose aggregate by grinding to level indicated in polished concrete specifications.
 - e. Tolerances: Floors - ACI 117, Class A. In addition, floor slabs shall not vary more than 1/16" in any 2'-0" from a true, straight edge non-accumulative.
- H. CURING AND PROTECTION: ACI 301 and ACI 308
- 1. All exposed surfaces of concrete including floor slabs, whether or not they receive a finish flooring, shall be protected from premature drying for a minimum of seven (7) days. Freshly placed concrete shall be protected against wash by rain. Apply the curing compound at a rate equivalent to the rate of application at which the curing compound was originally tested for conformance to the requirements of ASTM C309.
 - a. Cold-weather concreting ("Cold-Weather Concreting" - ACI Report 306).
 - b. Hot-weather concreting ("Hot-Weather Concreting" - American Concrete Institute Committee 305).
 - 2. All curing methods are to be placed immediately after final finishing (i.e., within two hours). Contractor's attention is directed to the fact that experience shows the most important time of curing is from three to four hours after placing and extending five to six hours thereafter. It is extremely important, therefore, to prevent loss of moisture, particularly during this period when concrete is especially vulnerable to shrinkage cracks.
 - 3. During the period of curing, no traffic on or loading of the floors will be permitted.
 - 4. All interior floor slabs to receive resilient tile or to be left exposed shall be cured with the specified clear curing compound, ASTM C309 Type 1, Class A. The resulting surface is to be dust-free and compatible with all resilient floor adhesives, or other finish materials specified.
- I. Patching And Repair: ACI 301 and ACI 503.2 - Standard specifications for bonding plastic concrete to hardened concrete with a multiple component epoxy adhesive.
- J. Evaluation And Acceptance Of Concrete: ACI 301.

3.05 ACCEPTANCE OF STRUCTURE: ACI 301

3.06 NON-SHRINK GROUT

- A. Preparation:
- 1. All defective concrete, laitance, dirt, oil, grease, and loose material shall be removed from the concrete bearing surface by bushhammering, chipping, or other means until sound, clean concrete is obtained. The bearing surface shall be left reasonably rough but not so rough as to interfere with proper placing of the grout. The area shall be covered as completely as possible with waterproof paper to prevent contamination prior to grouting.
 - 2. The bottom of the setting plates shall be cleaned of all dirt, rust, oil, grease, and loose material. Setting plates shall be aligned and leveled in their final position and maintained in that position during grouting.
 - 3. Special care shall be taken with the grout in hot and cold weather to ensure proper setting and gain of strength in accordance with the information supplied by the manufacturer of the ready-to-use grouting materials.
 - 4. Prior to grouting, the waterproof paper shall be removed and all loose dirt and matter cleaned away by compressed air or other means. Remove oil, grease, and other foreign matter from the bearing surface and setting plate. Saturate concrete surfaces with water

and scrub sides and bottom with a circular brush such as a bottle brush. Remove excess water from the surface just prior to placing the grout.

- B. Mixing:
 - 1. Grout material and water shall be mixed in accordance with Manufacturer's recommendations in a mortar mixer to ensure even distribution of components.
 - 2. Mixer shall be as close as possible to the plate to be grouted. Adequate means shall be provided to transport the mixed grout to the plate being grouted as quickly as possible and in such a manner as to prevent segregation.
 - 3. No more grout shall be mixed at one time than can be placed in a period of 30 minutes. After the grout has been mixed, it shall not be retempered by adding additional water.
- C. Grouting:
 - 1. The grout shall be placed quickly and continuously to avoid undesirable effects of overworking or stiffening which might result in breaking down of the initial set.
 - 2. The grout shall be placed by the most practical means that results in completely filling the space to be grouted. The grout may be poured in place or pressure-grouted by gravity or a plunger. The use of pneumatic pressure or dry-packed grouting requires approval of the Structural Engineer.
 - 3. Whenever practicable, grout shall be poured from one side only so as to flow across to the open side to avoid air entrapment.
 - 4. Grout shall be thoroughly compacted and free of air pockets.
 - 5. Form shoulder and trowel smooth.

3.07 APPLICATION OF VAPOR BARRIER

- A. Vapor Barrier: Follow manufacturer's recommendations.
 - 1. Lay sheeting on prepared subgrade in as large sheets as practical.
 - 2. Lap joints and seams 6" minimum and seal all joints with mastic.
 - 3. Turn sheet up and/or through wall.
 - 4. Supervise prior to covering to prevent punctures; repair those which occur and seal completely.

END OF THIS SECTION

**SECTION 03 3543
BONDED ABRASIVE POLISHED CONCRETE FLOORS**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes: Products and procedures for bonded abrasive polished concrete floors using multi-step wet/dry mechanical process, and accessories indicated, specified, or required to complete polishing.

1.02 DEFINITIONS

- A. Terminology: As defined by Concrete Polishing Council (CPC) glossary.
- B. Polished Concrete: The act of changing a concrete floor surface, with or without surface exposure of aggregate, to achieve a specified level of appearance.
- C. Bonded Abrasive Polished Concrete: The multi-step operation of mechanically grinding, honing, and polishing a concrete floor surface with bonded abrasives to cut a concrete floor surface and to refine each cut to the maximum potential to achieve a specified level of appearance as defined by the CPC.

1.03 SUBMITTALS

- A. Product Data: Manufacturer’s technical literature for each product indicated, specified, or required. Include manufacturer’s technical data, application instructions, and recommendations.
- B. Installer Qualifications: Data for company, principal personnel, experience, and training specified in PART 1 “Quality Assurance” Article.
- C. Maintenance Data: For inclusion in maintenance manual required by Division 01.
 - 1. Include instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
 - 2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.04 QUALITY ASSURANCE

- A. Polisher Qualifications:
 - 1. Experience: Company that has successfully completed five projects similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
 - 2. Supervision: Maintain a competent supervisor who is at Project during times specified work is in progress, and is currently certified as Craftsman - Level I or higher by CPAA, CPC Craftsman, or equivalent.
 - 3. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.
- B. Field Mock-up: Before performing work of this Section, provide following field mock-up to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless Architect specifically approves deviations in writing.
 - 1. Form, reinforce, and cast concrete slab for 10 foot square field mock-up.
 - 2. Concrete shall be same mix design as scheduled for Project.
 - 3. Placement and finishing work shall be performed by same personnel as will place and finish concrete for Project.
 - 4. Mock-up shall be representative of work to be expected.
 - 5. Perform grinding, honing, and polishing work as scheduled for Project using same personnel as will perform work for Project.
 - 6. Approval is for following aesthetic qualities:
 - a. Compliance with approved submittals.
 - b. Compliance with specified aggregate exposure class.
 - c. Compliance with specified appearance level.

7. Obtain Architect's approval before starting work on Project.
 8. Protect and maintain approved field mock-ups during construction in an undisturbed condition as a standard for judging completed work.
- C. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections.
1. Required Attendees:
 - a. Owner.
 - b. Architect.
 - c. Contractor, including supervisor.
 - d. Concrete producer
 - e. Concrete finisher, including supervisor.
 - f. Concrete polisher, including supervisor.
 - g. Technical representative of liquid applied product manufacturers.
 2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
 - a. Tour field mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
 - b. Review Contract Document requirements.
 - c. Review approved submittals and field mock-up. d. Review procedures, including, but not limited to:
 - 1) Applicable Division 03 Section on cast-in-place concrete
 - (a) Specific mix design.
 - (b) Specified curing methods/procedures.
 - (c) Projected 3, 14, and 28 day compressive strength test for finished floor and project phasing.
 - (d) Protection of concrete substrate during construction and prior to polishing process.
 - (e) Project phasing and scheduling for each step of grinding, honing and polishing operations including, but not limited to:
 - (1) Quality of qualified personnel committed to project. ii. Quality and size of grinders committed to project.
 - (2) Proper disposal of concrete slurry and/or concrete dust.
 - (f) Details of each step of grinding, honing, and polishing operations.
 - (1) Application of liquid applied products.
 - (2) Protecting polished concrete floors after polishing work is complete.
 3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.05 FIELD CONDITIONS

- A. Damage and Stain Prevention: It is the responsibility of the General Contractor to prevent damage and staining of concrete surfaces to be polished.
1. Prohibit use of markers, spray paint, and soapstone.
 2. Prohibit improper application of liquid membrane film forming curing compounds.
 3. Prohibit vehicle parking over concrete surfaces.
 4. Prohibit pipe-cutting operations over concrete surfaces.
 5. Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.
 6. Prohibit ferrous metals storage over concrete surfaces.
 7. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.
 8. Protect from acids and acidic detergents contacting concrete surfaces.

9. Protect from painting activities over concrete surfaces.
 10. Prohibit temporary nailing into concrete surface where floor will be exposed.
- B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 – PRODUCTS

2.01 LIQUID APPLIED PRODUCTS

- A. Liquid Densifier: An aqueous solution of silicon dioxide dissolved in one of the following hydroxides that penetrates into the concrete surface and reacts with the calcium hydroxide to provide a permanent chemical reaction that hardens and densifies the wear surface of the cementitious portion of the concrete.
1. Sodium Silicate
 2. Potassium Silicate
 3. Lithium Silicate
 4. Alkali solution of Colloidal Silicates or Silica

2.02 ACCESSORIES

- A. Repair Material: A product that is designed to repair cracks and surface imperfections. The specified material must have sufficient bonding capabilities to adhere after the polishing to the concrete surface and provide abrasion resistance equal to or greater than the surrounding concrete substrate.
- B. Grout Material: A thin mortar used for filling spaces. Acceptable products shall be:
1. Epoxy, urethane, polyurea, or polyaspartic resins.
 2. Latex or acrylic binders mixed with cement dust from previous grinding steps.
 3. Silicate binders mixed with cement dust from previous grinding steps.

2.03 POLISHING EQUIPMENT

- A. Field Grinding and Polishing Equipment:
1. A multiple head, counter rotating, walk behind or ride on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete. Excludes janitorial maintenance equipment.
 2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments to meet OSHA requirements.
 3. If wet grinding, honing, or polishing, use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.
- B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces the same results, without noticeable differences, as field grinding and polishing equipment.
- C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.
- D. Diamond Tooling: Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc) that are attached to rotating heads to refine the concrete substrate.
1. Bonded Abrasive: Abrasive medium that is held within a bonding that erodes away to expose new abrasive medium as it is used.
 2. Metal Bond Tooling: Diamond tooling that contains industrial grade diamonds with a metallic bonded matrix that is attached to rotating heads to refine the concrete substrate. These tools are available in levels of soft, medium, and hard metallic matrices that are matched with contrasting concrete substrates (i.e. hard matrix/soft concrete, medium matrix/medium concrete, soft matrix/hard concrete) and are typically used in the grinding and early honing stages of the polishing process.
 3. Resin Bond Tooling: Diamond tooling that contains industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, and thermoplastic-phenolic) that is

attached to rotating heads to refine the concrete substrate. Resin bond tooling does not have the soft/medium/hard characteristics of metal bond tooling and are typically used for the later honing and polishing stages of the polishing process.

4. Hybrid Tooling: Diamond tooling that combines metal bond and resin bond that has the characteristics of both types of tooling. These types of tools are typically used as either transitional tooling from metal bond tools to resin bond tools or as a first cut tool on smooth concrete surfaces.
5. Transitional Tooling: Diamond tooling that is used to refine the scratch pattern of metal bond tooling prior to the application of resin bond tooling in an effort to extend the life of resin bond tooling and to create a better foundation for the polishing process.
6. Abrasive Pad: An abrasive pad, resembling a typical floor maintenance burnishing pad that has the capability of refining the concrete surface on a microscopic level that may or may not contain industrial grade diamonds. These pads are typically used for the maintenance and/or restoration of previously installed polished concrete flooring.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Acceptance of Surfaces and Conditions:
 1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
 - a. Concrete finished floor flatness according to applicable Division 03 Section on cast-in-place concrete.
 - b. Concrete curing methods according to applicable Division 03 Section on cast-in-place concrete.
 - c. Concrete compressive strength according to applicable Division 03 Section on cast-in-place concrete.
- B. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
- C. Starting work within a particular area will be construed as acceptance of surface conditions.

3.02 PREPARATION

- A. Cleaning New Concrete Surfaces:
 1. Prepare and clean concrete surfaces.
 2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

3.03 3.03 POLISHING CONCRETE FLOORS

- A. Perform all polishing procedures to ensure a consistent visual appearance from wall to wall.
- B. Initial Grinding:
 1. Use grinding equipment with metal or semi-metal bonded tooling.
 2. Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.
 3. Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, up to 100 grit metal bonded tooling.
 4. Achieve maximum refinement with each pass before proceeding to finer grit tools.
 5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
 6. Continue grinding until aggregate surface exposure matches approved field mock-up.
- C. Treating Surface Imperfections:
 1. Mix patching compound or grout material with dust created by grinding operations, manufacturer's tint, or sand to match color of adjacent concrete surfaces.

2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.
 3. Work compound and treatment until color differences between concrete surface and filled surface imperfections, compared to mockup, are not reasonably noticeable when viewed from 20 feet away under lighting conditions that will be present after construction.
- D. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow curing according to manufacturer's instructions.
- E. Grout Grinding:
1. Use grinding equipment and appropriate grit and bond diamond tooling.
 2. Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.
 3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
- F. Honing:
1. Use grinding equipment with hybrid or resin bonded tooling.
 2. Hone concrete in one direction starting with 100 grit tooling and make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, up to 400 grit tooling reaching maximum refinement with each pass before proceeding to finer grit tooling.
 3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
- G. Polishing:
1. Use polishing equipment with resin-bonded tooling.
 2. Begin polishing in one direction starting with 800 grit tooling.
 3. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of appearance has been achieved.
 4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
 5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
 6. Stain Protection: Uniformly apply and remove excessive liquid according to manufacturer's instructions. Final film thickness should be less than .05 mils after cure.
 7. Final Polish: Using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.
- H. Final Polished Concrete Floor Finish:
1. Aggregate Exposure Class B – Fine Aggregate: Surface exposure of 85 to 95% fine aggregate and 5 to 15% cement fines and coarse aggregate based on visual observation of the overall area of the polished floor.
 2. Appearance Level 3 – Polished:
 - a. Procedure: Recommended not less than 4 steps with full refinement of each diamond tool with one application of densifier.
 - b. Measurement: Determine the Image Clarity Value,%, and the Haze Index:
 - 1) Image Clarity Value, %: An average value of 40 to 69 measured in accordance with ASTM D5767 prior to the application of sealers.
 - 2) Haze Index: An average value less than 10 measured in accordance with ASTM D4039 prior to the application of sealers.
 - 3) The minimum number of tests distributed across the polished surface should be three, for areas up to 1000 ft² and one additional test for each 1000 ft² or fraction thereof. This applies to both the Image Clarity Value and Haze Index.

3.04 3.04 PROTECTION

- A. Protection is the responsibility of the General Contractor.

END OF SECTION

**SECTION 04 0511
MORTAR AND MASONRY GROUT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mortar for masonry.
- B. Grout for masonry.

1.02 REFERENCE STANDARDS

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- B. ASTM C5 - Standard Specification for Quicklime for Structural Purposes; 2010.
- C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
- D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2017a.
- E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2017.
- F. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
- G. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
- I. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2015.
- J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
- K. ASTM C476 - Standard Specification for Grout for Masonry; 2018.
- L. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2017.
- M. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2016.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.
- C. Samples: Submit two samples of mortar, illustrating mortar color and color range.
- D. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.06 FIELD CONDITIONS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.

- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

- A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.
- B. Mortar Mix Designs: ASTM C270, Property Specification.
 - 1. Masonry below grade and in contact with earth: Type S.
 - 2. Exterior, Loadbearing Masonry: Type N.
 - 3. Exterior, Non-loadbearing Masonry: Type N.

2.02 MATERIALS

- A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Color: Standard gray.
- B. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
- C. Portland Cement: ASTM C150/C150M.
 - 1. Type: Type I - Normal; ASTM C150/C150M.
 - 2. Color: Standard gray.
- D. Masonry Cement: ASTM C91/C91M.
 - 1. Type: Type N; ASTM C91/C91M.
- E. Hydrated Lime: ASTM C207, Type S.
- F. Quicklime: ASTM C5, non-hydraulic type.
- G. Mortar Aggregate: ASTM C144.
- H. Grout Aggregate: ASTM C404.
- I. Water: Clean and potable.
- J. Bonding Agent: Latex type.

2.03 MORTAR MIXING

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.
- D. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 GROUT MIXING

- A. Mix grout in accordance with ASTM C94/C94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

PART 3 EXECUTION

3.01 PREPARATION

- A. Apply bonding agent to existing concrete surfaces.
- B. Plug clean-out holes for grouted masonry with brick masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION

- A. Install mortar and grout to requirements of section(s) in which masonry is specified.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not install grout in lifts greater than 16 inches (400 mm) without consolidating grout by rodding.
- D. Do not displace reinforcement while placing grout.
- E. Remove excess mortar from grout spaces.

3.03 GROUTING

- A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of Contract Documents.
- B. Low-Lift Grouting:
 - 1. Limit height of pours to 12 inches (300 mm).
 - 2. Limit height of masonry to 16 inches (400 mm) above each pour.
 - 3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
 - 4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.
- C. High-Lift Grouting:
 - 1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
 - 2. Brick: Limit pours to maximum 12 feet (3.66 m) in height and 25 feet (7.6 m) horizontally.
 - 3. Hollow Masonry: Limit lifts to maximum 4 feet (1.2 m) and pours to maximum height of 24 feet (7.3 m).
 - 4. Place grout for spanning elements in single, continuous pour.

END OF SECTION

**SECTION 04 2001
MASONRY VENEER**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Clay facing brick.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Installation of lintels.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 04 0511 - Mortar and Masonry Grout.
- B. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.
- D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- F. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016.
- G. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2017.
- H. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.
- I. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
- J. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2017.
- K. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2017.
- L. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
- M. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- N. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2017a.
- O. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
- P. ASTM C476 - Standard Specification for Grout for Masonry; 2018.
- Q. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale); 2017a.
- R. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- S. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015.

- T. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
- U. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
- V. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.
- C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.05 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 work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.07 FIELD CONDITIONS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 UNIT MASONRY - GENERAL

2.02 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations.
 - 2. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block, as indicated.
 - b. Exposed Faces: Manufacturer's standard color and texture where indicated.
 - 3. Non-Loadbearing Units: ASTM C129.
 - a. Hollow block, as indicated.

2.03 BRICK UNITS

- A. Manufacturers:
 - 1. Acme Brick Company.
 - 2. General Shale Brick; _____: www.generalshale.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
 - 1. Color and Texture: to be determined by the Architect.
 - 2. Nominal Size: Modular.
 - 3. Special Shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
 - 4. Compressive Strength: 2,500 p.s.i., measured in accordance with ASTM C67/C67M.

2.04 MORTAR AND GROUT MATERIALS

- A. Mortar and Grout: As specified in Section 04 0511.

2.05 REINFORCEMENT AND ANCHORAGE

- A. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 - 1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 - 2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.
 - 3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).
 - 4. Seismic Feature: Provide lip, hook, or clip on end of wire ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch (3.8 mm) diameter.
 - 5. Manufacturers:
 - a. Hohmann & Barnard, Inc; _____: www.h-b.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 FLASHINGS

- A. EPDM Flashing: ASTM D4637/D4637M, Type I, 0.040 inch (1.0 mm) thick.
 - 1. Manufacturers:
 - a. Heckmann Building Products, Inc; _____: www.heckmannbuildingprods.com/#sle.
 - b. Hohmann & Barnard, Inc; _____: www.h-b.com/#sle.
- B. Termination Bars: Stainless steel; compatible with membrane and adhesives.
 - 1. Manufacturers:
 - a. Mortar Net Solutions; Termination Bars: www.mortarnet.com/#sle.

2.07 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
- C. Weeps:
 - 1. Type: Polyester mesh.
 - 2. Color(s): As selected by Architect from manufacturer's full range.
 - 3. Manufacturers:
 - a. Mortar Net Solutions; WeepVent: www.mortarnet.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. Cavity Vents:
 - 1. Type: Polyester mesh.
 - 2. Color(s): As selected by Architect from manufacturer's full range.
 - 3. Manufacturers:
 - a. Mortar Net Solutions; CellVent: www.mortarnet.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- E. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
- F. Termination Bars: Stainless steel; compatible with membrane and adhesives.
- G. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
 - 3. Mortar Joints: Flush.
- D. Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: Three units and three mortar joints to equal 8 inches (200 mm).
 - 3. Mortar Joints: Concave.

3.03 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar as work progresses.
- E. Interlock intersections and external corners, except for units laid in stack bond.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

3.04 WEEPS/CAVITY VENTS

- A. Install weeps in veneer walls at 24 inches (600 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.
- B. Install cavity vents in veneer walls at 32 inches (800 mm) on center horizontally below shelf angles and lintels and at top of walls.

3.05 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.06 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- C. Place continuous joint reinforcement in first joint below top of walls.
- D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch (16 mm) mortar cover on each side.
- E. Lap joint reinforcement ends minimum 6 inches (150 mm).
- F. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches (400 mm) on center vertically and 16 inches (400 mm) on center

horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

- G. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

3.07 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
1. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up at least 1 inch (25.4 mm), minimum, to form watertight pan at non-masonry construction.
 2. Remove or cover protrusions or sharp edges that could puncture flashings.
 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Extend plastic and EPDM flashings to within 1/4 inch (6 mm) of exterior face of masonry.
- C. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.

3.08 LINTELS

- A. Install loose steel lintels over openings.
- B. Maintain minimum 8 inch (____ mm) bearing on each side of opening.

3.09 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- C. See drawings for locations and spacing.

3.10 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm in 3 m) and 1/2 inch in 20 ft (13 mm in 6 m) or more.
- C. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm in 1 m) and 1/4 inch in 10 ft (6 mm in 3 m); 1/2 inch in 30 ft (13 mm in 9 m).
- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

3.11 CUTTING AND FITTING

- A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.12 CLEANING

- A. Remove excess mortar and mortar smears as work progresses.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.
- E. Wash all masonry surfaces with non-acidic cleaning solution.

3.13 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 04 2200
CONCRETE UNIT VENEER MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete Masonry Veneer Units.

1.02 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Samples: Submit 4 samples to illustrate color, texture, and extremes of color range.

1.03 QUALITY ASSURANCE

- A. Certifications: Units are hollow and solid non-load bearing concrete masonry units of multiple sizes with faces that are either split utilizing blades exerting pressure from all four sides of product utilizing a drum roller after product has been split. Units are manufactured by means of moisture-controlled curing for 24 hours minimum. Concrete blocks for finishing shall conform to ASTM C90 for Normal Weight. All units contain an integral water repellent CMU admixture at the time of manufacture. Units shall conform to ASTM C744 with respect to abrasion, crazing resistance, and color change
- B. Construct a sample panel no less than 4' x 6' containing each color and size units to be used in the project illustrating color, clear sealer finish, texture, and mortar joints to establish a standard of quality for completed work. Mock-Up shall also illustrate product and mortar combination, coursing, bond, unit size ratio, and pattern. Retain mock-up during construction as a quality standard. Completely remove when work is accepted.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Units shall be delivered on covered wood pallets in such a way as to protect faces. Palletized units shall not be stacked on top of each other.
- B. Store in protected area and covered to ensure units remain dry and clean at all times. Do not allow units to sit in standing water or be exposed to rain.
- C. Handle masonry units in manner to avoid chipping, breaking, contact with contaminating materials, and marring of faces.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Nettlestone Custom 4" Ashlar Concrete Masonry Veneer: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions shall be from full list of standard sizes and nominal depth of 4 inches.
 - 2. Finish: Tumbleridge.

2.02 MANUFACTURER

- A. Nettleton Concrete, Inc. (800) 382-2462.
- B. Jonesboro, Arkansas

2.03 MORTAR AND GROUT MATERIALS

- A. Mortar and grout: As recommended by manufacturer and matches other masonry products.

2.04 WATER REPELLENCY

- A. Units to be manufactured with RainBloc integral water repellant, or approved equal, to assist in controlling efflorescence. Use of RainBloc mortar admixture, or approved equal, according to manufacturer's recommendations is required for a water repellant.

2.05 ANCHORS AND TIES

- A. Acceptable Manufacturers:
 - 1. Products of Hohmann and Barnard Bldg. Products, conforming to specification requirements are acceptable.
 - 2. Substitutions: Under provisions of the General Provisions.
- B. Anchors:
 - 1. Anchors shall be used suitable with steel stud backup walls.
 - 2. Anchor system for stone veneer shall be as recommended by the manufacturer.
 - 3. Zinc coating shall comply with ASTM A153-B2.

2.06 FLASHINGS

- A. Rubberized Asphalt Flashing: Self-adhering polymer-modified asphalt sheet; 0.030 inch (0.75 mm) total thickness; with cross-linked polyethylene top and bottom surfaces.
 - 1. Manufacturers:
 - a. Hohmann & Barnard, Inc..
 - b. Substitutions: See Section 01600 - Product Requirements.

2.07 ACCESSORIES

- A. Weep Holes: Open head joints 24" horizontal at base of wall above thru-wall flashing. Provide Mortar Net weeps at each weep hole.
- B. Compressible Filler: Premolded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE41E1, capable of compression up to 35% of width and thickness indicated.
- C. Mortar Net: Provide TotalFlash system along base of air space.
- D. Masonry Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials as recommended by manufacturer. Do not apply cleaner with a pressure sprayer above 50 psi..

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation.

3.03 COURSING

- A. Install in accordance with manufacturer's recommended layout for product.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Mortar Joints: Concave.

3.04 PLACING AND BONDING

- A. Lay units from more than on pallet at a time during installation. Complete masonry construction using procedures and workmanship consistent with quality masonry practices.
- B. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

3.05 CUTTING

- A. Field cut units with motor-driven masonry saws using an abrasive or diamond blade to provide straight true edges and avoid damage to face.
- B. Field split and chisel corners with suitable tools to insure uniform texture and consistency of face.
- C. Do not install chipped or broken units

3.06 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control and expansion joints.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- D. Size control joint in accordance with Section 07900 for sealant performance.

3.07 CLEANING

- A. Exercise care that wet mortar is not splashed onto burnished face during installation.
- B. Excess or splashed mortar shall be cleaned from face with dry burlap wipe or masonry brush.
- C. Remove after mortar becomes hard enough not to smear but prior to mortar setting.
- D. Final Cleandown: Clean completed wall surfaces using masonry cleaners such as Specialty Masonry Cleaner, manufactured by Diedrich Technologies, Inc. Dilute cleaning solution as recommended by manufacturer. Strictly follow manufacturers cleaning instructions. Do not use acid or abrasives on finished surfaces. Do not power wash. High pressure power washing may interfere with performance of the integral water repellent causing efflorescence.
- E. PROTECTION
- F. During erection, cover top of walls with waterproof sheeting at end of each day. Cover partially completed walls when work is not in progress. Extend cover 24 inches minimum down both sides and hold securely in place. Protect face of walls, sills, and other projections from roof run-off, splashed water, mud, grout, and mortar. Spread sand or straw at base of walls to minimize dirt and clay splashing onto burnished faces. Without damaging completed work, it is recommended to provide protective boards at exposed external corners which may be damaged by construction activities.
- G. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 4000
COLD-FORMED METAL FRAMING**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Formed steel stud exterior wall and interior wall framing.

1.02 REFERENCE STANDARDS

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. 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; 2017.
- D. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a (Reapproved 2015).
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).
- F. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.
- G. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- H. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
- D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention, and _____.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Metal Framing:
 - 1. ClarkDietrich; _____: www.clarkdietrich.com/#sle.
 - 2. Marino; _____: www.marinoware.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Framing Connectors and Accessories:
 - 1. ClarkDietrich; _____: www.clarkdietrich.com/#sle.
 - 2. Simpson Strong Tie; _____: www.strongtie.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.03 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; studs formed to channel, C- or Sigma-shaped with punched web; U-shaped track in matching nominal width and compatible height.
1. Gauge and Depth: As indicated on drawings.

2.04 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
B. Anchorage Devices: Powder actuated and as indicated on structural documents..
C. Welding: Comply with AWS D1.1/D1.1M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.
B. Place studs at 16 inches (400 mm) on center; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.
C. Install intermediate studs above and below openings to align with wall stud spacing.
D. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
E. Attach cross studs to studs for attachment of fixtures anchored to walls.
F. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/8" inch (3 mm).

END OF SECTION

**SECTION 05 4400
COLD-FORMED METAL TRUSSES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Light gauge cold-formed steel roof trusses.
- B. Anchorages, bracing, and bridging.

1.02 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2018).
- B. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
- C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).
- D. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).
- F. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.
- G. CFSEI 5000 - Field Installation Guide for Cold-Formed Steel Roof Trusses; May 2000.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Span charts.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings:
 - 1. Include detailed roof truss layout.
 - 2. Show member type, location, spacing, size and gauge, methods of attachment, and erection details. Indicate supplemental bracing, strapping, splices, bridging, and accessories.
 - 3. Include truss design drawings, signed and sealed by a qualified professional engineer registered in ARKANSAS, verifying ability of each truss design to meet applicable code and design requirements.
 - a. Include the following:
 - 1) Design criteria.
 - 2) Engineering analysis depicting member stresses and deflections.
 - 3) Member sizes and gauges.
 - 4) Details of connections at truss joints.
 - 5) Truss support reactions.
 - 6) Bracing requirements.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: Steel truss fabricator with minimum 10 years of experience designing and fabricating truss systems equivalent to those required for this project and licensed by an acceptable manufacturer.
- B. Installer Qualifications: Experienced installer approved by truss system fabricator.
- C. Welders: Qualify welding processes and welding operators in accordance with AWS B2.1/B2.1M.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver trusses and other materials in manufacturer's unopened bundles or containers, each marked with manufacturer's name, brand, type, and grade. Exercise care to avoid damage during unloading, storing, and erection.
- B. Store trusses on blocking, pallets, platforms, or other supports, off the ground and in an upright position, sufficiently braced to avoid damage from excessive bending. Gently slope stored trusses to avoid accumulation of water on interior of truss chord members.
- C. Protect trusses and accessories from contact with earth, corrosion, deformation, mechanical damage, or other deterioration when stored at project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cold-Formed Steel Trusses:
 - 1. Aegis Metal Framing, a Division of MiTek Industries; _____: www.aegismetalframing.com/#sle.
 - 2. Alpine TrusSteel, an ITW Company Inc; _____: www.trussteel.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TRUSS DESIGN REQUIREMENTS

- A. Design: Calculate structural characteristics of cold-formed steel truss members according to AISI S100.
- B. Structural Performance: Design, engineer, fabricate, and erect trusses to withstand specified design loads for project conditions within required limits.
 - 1. Design Loads: In accordance with applicable codes and structural documents. The most restrictive design requirement to be used if there is a discrepancy between code requirements and structural documents .
 - a. Roof Live Loads:
 - 1) See structural documents for all load requirements.
 - 2. Deflections: Live load deflection meeting the following, unless otherwise indicated:
 - a. Roofs: Maximum vertical deflection under live load of 1/360 of span (confirm with structural documents).
 - 3. Design trusses to accommodate movement attributable to temperature changes within a range of 120 degrees F (67 degrees C) without damage or overstressing, sheathing failure, undue strain on fasteners and anchors, or other deleterious effects.

2.03 COMPONENTS

- A. Trusses: Light gauge steel assemblies providing a complete horizontal framing system for locations indicated, ready for deck installation.
- B. Fasteners: Self-drilling, self-tapping screw fasteners with corrosion-resistant plated finish, as recommended by steel truss manufacturer and marked for easy identification.
 - 1. Welding: Comply with applicable provisions of AWS D1.1/D1.1M and AWS D1.3/D1.3M.
- C. Bracing, Bridging, and Blocking Members: Fabricate required shapes from commercial quality galvanized steel sheet complying with ASTM A653/A653M as required for load conditions.

2.04 FABRICATION

- A. Factory fabricate cold-formed steel trusses plumb, square, true to line, and with secure connections, complying with manufacturer's recommendations and project requirements. Verify Dimensions and site conditions prior to fabrication.
 - 1. Fabricate trusses using jig templates.
 - 2. Cut truss members by sawing, shearing, or plasma cutting.
 - 3. Fasten members in full compliance with instructions of manufacturer. Wire tying of framing members is not permitted.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Examine structure, substrates, and installation conditions. Notify Architect of unsatisfactory preparation. Do not begin installation until substrates have been properly prepared and unsatisfactory conditions have been corrected.
- B. Proceeding with installation indicates installer's acceptance of substrate conditions.

3.02 INSTALLATION

- A. Install cold-formed steel trusses in strict accordance with manufacturer's instructions and approved shop drawings, using approved fastening methods.
- B. Install temporary erection bracing and permanent bracing and bridging before application of any loads. Erect trusses with plane of truss webs vertical and parallel to each other, accurately located at spacing indicated. Anchor trusses securely at bearing points.
- C. Adequately distribute applied loads to avoid exceeding the carrying capacity of any one joint, truss, or other component.
- D. Exercise care to avoid damaging truss members during lifting and erection and to minimize horizontal bending of trusses.
- E. Removal, cutting, or alteration of any truss chord, web, or bracing member in the field is prohibited, unless approved in advance by Architect or the engineer of record and the truss manufacturer.
- F. Repair or replace damaged members and complete trusses as directed and approved in writing by Architect or the engineer of record and the truss manufacturer.
- G. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.
- H. Roof Trusses:
 - 1. Comply with recommendations of CFSEI 5000.
 - 2. Align truss bottom chords with load-bearing studs or continuously reinforce track as required to transfer loads to structure.
 - 3. Install continuous bridging and permanent truss bracing as indicated.
 - 4. Install roof cross bracing and diagonal bracing as indicated.

3.03 PROTECTION

- A. Protect trusses from damage by subsequent construction activities.
- B. Repair or replace damaged trusses, truss members, and bracing members; obtain approval in advance by Architect or the engineer of record and the truss manufacturer for all cutting, repairs, and replacements.

END OF SECTION

**SECTION 06 1000
ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concealed wood blocking, nailers, and supports.
- B. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.
- C. PS 20 - American Softwood Lumber Standard; 2015.
- D. SPIB (GR) - Grading Rules; 2014.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
- B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: Kiln-dry or MC15.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.

- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing. Plywood may be used in lieu of wood blocking.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Provide the following specific nonstructural framing and blocking:
 1. Cabinets and shelf supports.
 2. Wall brackets.
 3. Handrails.
 4. Grab bars.
 5. Towel and bath accessories.
 6. Wall-mounted door stops.
 7. Chalkboards and marker boards.
 8. Wall paneling and trim.
 9. Joints of rigid wall coverings that occur between studs.
 10. Wall-mounted TV locations

3.04 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.05 INSTALLATION OF CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 3. Install adjacent boards without gaps.

3.06 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Surface Flatness of Floor: 1/8 inch in 10 feet (1 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.
- C. Variation from Plane, Other than Floors: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.07 CLEANING

- A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
 1. Comply with applicable regulations.
 2. Do not burn scrap on project site.
 3. Do not burn scraps that have been pressure treated.
 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 1600
ZIP WALL SHEATHING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes
 1. Wall sheathing with integral water-resistive barrier and air barrier.

1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME): www.asme.org
 1. ASME B18.6.1 - Wood Screws (Inch Series)
- B. ASTM International (ASTM): www.astm.org
 1. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 2. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials
 3. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings
 4. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials
 5. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
- C. US Department of Commerce (DOC): <http://gsi.nist.gov/global/index.cfm/L1-5/I2-44/A-355>
 1. DOC PS 2 - Performance Standard for Wood-Based Structural Panels
- D. International Code Council (ICC): www.iccsafe.org
 1. ICC IBC - International Building Code
 2. ICC IRC - International Residential Code for One- and Two-Family Dwellings
- E. ICC Evaluation Service, Inc. (ICC-ES): www.icc-es.org
 1. AC38 – Acceptance Criteria for Weather Resistive Barriers
 2. ICC-ES AC116 - Acceptance Criteria for Nails and Spikes
 3. ICC-ES AC148 - Acceptance Criteria For Flexible Flashing Materials
 4. ICC-ES AC201 - Acceptance Criteria for Staples
 5. ICC-ES AC266 - Acceptance Criteria for Wood Structural Panel Roof Sheathing Factory-Laminated with an Alternate Roof Underlayment
 6. ICC-ES AC310 - Acceptance Criteria for Water-Resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-Resistive Barriers
 7. ICC-ES ESR-1539 - Power Driven Staples and Nails for Use in Engineered and Non-Engineered Connections
 8. ICC-ES NER-272 - Power Driven Staples and Nails for Use in All Types of Building Construction
- F. Sustainable Forestry Initiative (SFI): www.sfiprogram.org/
 1. SFI 2010 - 2014 Standard

1.03 ACTION SUBMITTALS

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

1.04 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: From ICC-ES, for wood sheathing and seam tape.
- B. Product Certifications: From manufacturer, indicating that sheathing products comply with ICC-ES AC266 and ICC-ES AC310.
- C. Certified Wood Certificates: Certificates indicating that manufacturer is currently certified by an SFI- or FSC- accredited certification body, and chain-of-custody certificates indicating that sheathing products comply with forest certification requirements.

1.05 CLOSEOUT SUBMITTALS

- A. Warranty: Executed copy of manufacturer special warranties.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide wood products from manufacturer certified by SFI, FSC, or comparable sustainable forestry program acceptable to Architect.
- B. Provide wall sheathing products meeting requirements for water-resistive barrier in accordance with ICC-ES AC310.
- C. Provide roof sheathing products meeting requirements for roof underlayments in accordance with ICC-ES AC266.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's written instructions for protection of sheathing products from weather prior to installation.

1.08 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which sheathing manufacturer agrees to repair or replace sheathing products that demonstrate deterioration or failure under normal use due to manufacturing defects within warranty period specified, when installed according to manufacturer's instructions.
 - 1. Warranty Period for Sheathing Products: 30 years following date of Substantial Completion.
 - 2. Warranty Conditions: Special warranties exclude deterioration or failure due to structural movement resulting in stresses on sheathing products exceeding manufacturer's written specifications, or due to air or moisture infiltration resulting from cladding failure or mechanical damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Provide sheathing products manufactured by Huber Engineered Woods LLC, Charlotte NC; Phone: (800) 933-9220; Website: www.zipsystem.com; www.huberwood.com

2.02 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Exterior Fire-Test Exposure: ASTM E108, Class A, when covered with approved Class A coverings.
 - 2. Fire-Resistance Ratings: Where indicated, provide assemblies tested for fire resistance per ASTM E119.
- B. Air-Barrier Assembly Air Leakage: Less than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.2 L/s x sq. m at 75 Pa), per ASTM E2375.
- C. Water-Vapor Permeance, Facer: Minimum 12 perms (689 ng/Pa x s x sq. m), ASTM E96/E96M.
- D. Weather Exposure: Manufacturer warranty applies for maximum allowable exposure period of 180 days.

2.03 WOOD PANEL PRODUCTS

- A. Single Source Limitations: Provide wall sheathing by a single manufacturer.
- B. Certified Wood: Provide sheathing produced from wood obtained from forests certified by an accredited certification body.
- C. Oriented Strand Board: DOC PS 2, made with binder containing no added urea formaldehyde.

2.04 WALL SHEATHING WITH INTEGRAL WATER-RESISTIVE BARRIER AND AIR BARRIER

- A. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing with factory-laminated water-resistive barrier facer with printed fastener location symbols.
 - 1. Basis-of-Design Product: Provide Huber Engineered Woods LLC; ZIP System Sheathing.

2. Span Rating, Panel Grade and Performance Category: 24/16; Structural 1; 7/16 Performance Category
3. Edge Profile: Square edge.
4. Facer: Medium-density, phenolic-impregnated sheet material qualifying as a Grade D weather-resistive barrier in accordance with ICC AC38.
5. Provide fastener spacing symbols on facer for 16-inch (406 mm) and 24-inch (610 mm) on center spacing.

2.05 FASTENERS

- A. Fasteners, General: Size and type complying with manufacturer's written instructions for Project conditions and requirements of authorities having jurisdiction.
 1. Corrosion Resistance: Hot-dip zinc coating, ASTM A153/A153M.
- B. Nails, Brads, and Staples: ICC AC116 and ICC AC201.
- C. Power-Driven Fasteners: ICC-ES-1539 or NER-272.
- D. Wood Screws: ASME B18.6.1.

2.06 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIAL

- A. Liquid-Applied Flashing Membrane: Gun-grade, cold-applied, silyl-terminated polyether (STPE) liquid flashing membrane compatible with sheathing / weather barrier and self-adhering seam and flashing tape, and tested as part of an assembly meeting performance requirements. Follow manufacturer's recommendation for integration with ZIP System Tape.
 1. Basis-of-Design Product: Provide Huber Engineered Woods; ZIP System Liquid Flash.
 2. Hardness, Shore A, ASTM C 661: 40 to 45.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine framing spacing and alignment to determine if work is ready to receive sheathing. Proceed with sheathing work once conditions meet requirements.

3.02 SHEATHING INSTALLATION

- A. Install sheathing panels in accordance with manufacturer's written instructions, requirements of applicable Evaluation Reports, and requirements of authorities having jurisdiction.
- B. Air and Moisture Barrier: Coordinate sheathing installation with flashing and joint sealant sequencing and installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier.
- C. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports.
- D. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs. Support all panel edges.
 1. Space square-edged panels 0.125 inch (3 mm).
 2. Butt edges of self-spacing edge panels.
- E. Attach sheathing panels securely to substrate with manufacturer-approved fasteners in compliance with the following:
 1. ICC-ES ESR-1539 or ICC-NES NER-272 for power-driven fasteners.
 2. IBC: Table 2304.9.1 Fastening Schedule.
- F. Apply liquid-applied flashing membrane at penetrations, gaps, and cracks to form continuous weathertight surface. Apply liquid membrane according to manufacturer's written instructions. Follow manufacturer's recommendation for integration with ZIP System Tape.

END OF SECTION

SECTION 06 1613
INSULATING ZIP WALL SHEATHING SYSTEM**PART 1 GENERAL****1.01 SUMMARY**

- A. Section includes insulating wall sheathing with integral water-resistive barrier and air barrier.

1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME): www.asme.org
1. ASME B18.6.1 - Wood Screws (Inch Series)
- B. ASTM International (ASTM): www.astm.org
1. ASTM A153/A153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 2. ASTM C1289 - Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
 3. ASTM D779 - Test Method for Water Resistance of Paper, Paperboard, and Other Sheet Materials by the Dry Indicator Method
 4. ASTM D1621 - Test Method for Compressive Properties Of Rigid Cellular Plastics
 5. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
 6. ASTM E96/E 96M - Test Methods for Water Vapor Transmission of Materials
 7. ASTM E331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
 8. ASTM E2357 - Test Method for Determining Air Leakage of Air Barrier Assemblies
 9. ASTM F1667 - Specification for Driven Fasteners: Nails, Spikes, and Staples
 10. ASTM G154 - Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
- C. US Department of Commerce (DOC): <http://gsi.nist.gov/global/index.cfm/L1-5/I2-44/A-355>
1. DOC PS 2 - Performance Standard for Wood-Based Structural Panels
- D. International Code Council (ICC): www.iccsafe.org
1. ICC IBC - International Building Code
 2. ICC IRC - International Residential Code for One and Two-Family Dwellings
- E. ICC Evaluation Service, Inc. (ICC-ES): www.icc-es.org
1. ICC-ES AC12 - Acceptance Criteria For Foam Plastic Insulation
 2. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers
 3. ICC-ES AC116 - Acceptance Criteria for Nails and Spikes
 4. ICC-ES AC148 - Acceptance Criteria For Flexible Flashing Materials
 5. ICC-ES AC201 - Acceptance Criteria for Staples
 6. ICC-ES AC269 - Acceptance Criteria for Racking Shear Evaluation of Proprietary Sheathing Materials attached to Light-Frame Wall Construction or Code-Complying Sheathing Attached to Light-Framed Walls with Proprietary Fasteners
 7. ICC-ES AC310 - Acceptance Criteria for Water-Resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-Resistive Barriers
 8. ICC-ES ESR-1539 - Power Driven Staples and Nails for Use in Engineered and Non-Engineered Connections
 9. ICC-ES NER-272 - Power Driven Staples and Nails for Use in All Types of Building Construction
- F. Sustainable Forestry Initiative (SFI): www.sfiprogram.org/
1. SFI 2010 - 2014 Standard

1.03 ACTION SUBMITTALS

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

1.04 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: From ICC-ES, for wood sheathing and seam tape.

- B. Product Certifications: From manufacturer, indicating that sheathing products comply with ICC-ES AC269 and ICC-ES AC310.
- C. Certified Wood Certificates: Certificates indicating that manufacturer is currently certified by an SFI- or FSC- accredited certification body, and chain-of-custody certificates indicating that sheathing products comply with forest certification requirements.

1.05 CLOSEOUT SUBMITTALS

- A. Warranty: Executed copy of manufacturer special warranties.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide wood products from manufacturer certified by SFI, FSC, or comparable sustainable forestry program acceptable to Architect.
- B. Provide wall sheathing products meeting requirements for water-resistive barrier in accordance with ICC-ES AC310.
- C. Provide wall sheathing products meeting requirements of ICC-ES AC269.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's written instructions for protection of sheathing products from weather prior to installation.

1.08 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which sheathing manufacturer agrees to repair or replace sheathing products that demonstrate deterioration or failure under normal use due to manufacturing defects within warranty period specified, when installed according to manufacturer's instructions.
 - 1. Warranty Period for Sheathing Products: 30 years following date of Substantial Completion.
 - 2. Warranty Conditions: Special warranties exclude deterioration or failure due to structural movement resulting in stresses on sheathing products exceeding manufacturer's written specifications, or due to air or moisture infiltration resulting from cladding failure or mechanical damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Provide sheathing products manufactured by Huber Engineered Woods LLC, Charlotte NC; Phone: (800) 933-9220; Website: www.zipsystem.com.

2.02 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Assembly Air Leakage: Less than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.2 L/s x sq. m at 75 Pa), per ASTM E2375.
- B. Water-Vapor Permeance, Facer: Minimum 12 perms (689 ng/Pa x s x sq. m), ASTM E96/E96M.
- C. Weather Exposure: Manufacturer warranty applies for maximum allowable exposure period of 180 days.

2.03 MATERIALS

- A. Certified Wood: Provide sheathing produced from wood obtained from forests certified by an accredited certification body.
- B. Oriented Strand Board: DOC PS 2, made with binder containing no added urea formaldehyde.
- C. Rigid Foam Plastic Insulating Board: Rigid polyisocyanurate foam core complying with ASTM C1289 Type II, Class 2, and ICC-ES AC12, with coated glass fiber facers on both sides, with the following characteristics:
 - 1. Nominal Density: 2.0 pcf (32 kg/cu. m).
 - 2. Compressive Strength, ASTM D1621: Not less than 20 psi (150 kPa).
 - 3. Vapor Permeance, ASTM E96/E96M: Less than 1.0 perm.

4. Edge Configuration: Square finished.

2.04 COMPOSITE INSULATING WALL SHEATHING

- A. Composite Insulating Wall Sheathing: Oriented-strand-board Exposure 1 sheathing 7/16 inch (11.1 mm) thick, with factory-laminated water-resistive barrier exterior facer, and with rigid foam plastic insulating board laminated to interior face.
 1. Basis-of-Design Product: Provide Huber Engineered Woods LLC; ZIP System R Sheathing.
 2. Span Rating and Performance Category of Sheathing Layer: Not less than 24/16; 7/16 Performance Category.
 3. Thickness: 1 inch (25 mm).
 4. Thermal Resistivity (R Value): 3.6 deg F x h x sq. ft./Btu x in. at 75 deg F ([25] [46] K x m/W at 24 deg C).
 5. Edge Profile: Square edge.
 6. Exterior Facer: Medium-density, phenolic-impregnated polymer-modified sheet material meeting requirements for ASTM D779 Grade D weather-resistive barrier in accordance with ICC AC38 and AC310, with fastener spacing symbols on exterior facer for 16-inch (406 mm) and 24-inch (610 mm) on center spacing, with the following characteristics
 - a. Water Resistance of Coatings, ASTM D2247: Pass 14 day exposure test.
 - b. Moisture Vapor Transmission, ASTM E96: Not less than 12 perms.
 - c. Water Penetration, ASTM E331: Pass at 2.86 lbf/sq. ft. (137 Pa).
 - d. Wind Driven Rain, TAS-100: Pass.
 - e. Accelerated Weathering, ASTM G154: Pass.

2.05 FASTENERS

- A. Fasteners, General: Size and type complying with manufacturer's written instructions for Project conditions and requirements of authorities having jurisdiction.
 1. Corrosion Resistance: Hot-dip zinc coating, ASTM A153/A 153M.
- B. Nails, Brads, and Staples: ICC AC116 and ICC AC201.
- C. Power-Driven Fasteners: ICC-ES-1539 or NER-272.
- D. Wood Screws: ASME B18.6.1.

2.06 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIAL

- A. Self-Adhering Seam and Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC AC148.
 1. Basis-of-Design Product: Provide Huber Engineered Woods; ZIP System Tape.
 2. Thickness: 0.012 inch (0.3 mm).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine framing spacing and alignment to determine if work is ready to receive sheathing. Proceed with sheathing work once conditions meet requirements.

3.02 SHEATHING INSTALLATION

- A. Install sheathing panels in accordance with manufacturer's written instructions, requirements of applicable Evaluation Reports, and requirements of authorities having jurisdiction.
- B. Air and Moisture Barrier: Coordinate sheathing installation with flashing and joint sealant installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier.
- C. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports.
- D. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs.
- E. Attach sheathing panels securely to substrate with manufacturer-approved fasteners in compliance with the following:
 1. ICC-ES ESR-1539 or ICC-NES NER-272 for power-driven fasteners.

2. IBC: Table 2304.9.1 Fastening Schedule.
- F. Apply seam tape at all panel seams, penetrations, and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.

END OF SECTION

**SECTION 07 1900
WATER REPELLENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water repellents applied to exterior, masonry surfaces.
- B. Pressure washing.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

- A. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2013).
- B. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes, and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments; 1991 (Reapproved 2013).
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description and chemical composition.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

1.05 FIELD CONDITIONS

- A. Protect liquid materials from freezing.
- B. Do not apply water repellent when ambient temperature is lower than 50 degrees F (10 degrees C) or higher than 100 degrees F (38 degrees C).

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
 - 1. BASF Construction Chemicals; ____: www.buildingsystems.basf.com/#sle.
 - 2. PROSOCO, Inc; ____: www.prosoco.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
 - 1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
 - 2. VOC Content: See Section 01 6116.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify joint sealants are installed and cured.
- C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.
- D. Verify surfacaces not to recieve product are protected.

3.02 PREPARATION

- A. Protection of Adjacent Work:

1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
 2. Protect adjacent surfaces not intended to receive water repellent.
- B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.
 - C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.
 - D. Remove loose particles and foreign matter.
 - E. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.
 - F. Pressure wash surfaces to be coated.
 - G. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

- A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.
- B. Apply at rate recommended by manufacturer, continuously over entire surface.
- C. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION

SECTION 07 2101
ACOUSTICAL INSULATION

PART 1 GENERAL

1.01 SUMMARY

- A. Provide mineral wool sound attenuation fire batt insulation in walls.

1.02 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM).
 - 1. E 84 Test Method for Surface Burning Characteristics of Building Materials.
 - 2. E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
 - 3. C 518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.
 - 4. C423 Test Method for Sound Absorption Coefficient by the Reverberation Room Method

1.03 SUBMITTALS

- A. Product Data: Submit product literature and installation instructions for specified insulation.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.
- B. Label insulation packages to include material name, production date and/or product code.
- C. Deliver and store materials under provision of Section 01 6000.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Insulation:
 - 1. Industrial insulation group, a Johns Manville Company.
 - 2. CertainTeed Corporation: www.certainteed.com
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SOUND ATTENUATION FIRE BATTS

- A. Type: Unfaced mineral wool acoustical insulation complying with ASTM C 665, Type I or ASTM C553, Type 5..
 - 1. Size: Thickness 3 ½" Wide
 - 2. Thickness Width Length
 - 3. 3½" 89mm 16" 406mm 24" 609mm 96" 2438mm
- B. Surface Burning Characteristics:
 - 1. Maximum flame spread: 5
 - 2. Maximum smoke developed: 0 when tested in accordance with ASTM E 84.
- C. Combustion Characteristics: Passes ASTM E 136.
- D. Fire Resistance Ratings: Passes ASTM E 119 as part of a complete fire tested wall assembly.
- E. Sound Transmission Class: Highest possible for thickness.
- F. Dimensional Stability: Linear Shrinkage less than 0.1%

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions under which insulation work is to be performed. A satisfactory substrate is one that complies with requirements of the section in which substrate and related work is specified.
- B. Verify mechanical and electrical services within the shaft wall have been tested and inspected.

- C. Obtain installer's written report listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.
- D. Clean substrates of substances harmful to insulation.

3.02 3.02 GENERAL INSTALLATION

- A. Comply with manufacturer's instructions for particular conditions of installation in each case.

3.03 PROTECTION

- A. Protect installed insulation as recommended by manufacturer.

3.04 SCHEDULE

- A. Install sound insulation in walls in the following locations:
 - 1. Restrooms;
 - 2. Exam rooms;
 - 3. Mechanical closets.

END OF SECTION

**SECTION 07 2102
THERMAL BATT INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass batt thermal insulation.

1.02 REFERENCES

- A. Materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:
 - 1. American Society for Testing of Materials (ASTM):
 - a. ASTM C423 Test Method for Sound Absorption Coefficient by the Reverberation Room Method.
 - b. ASTM C518 Test Method for Steady State Thermal Transmission properties by Means of the Heat Flow Meter.
 - c. ASTM C665 Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - d. ASTM C1320 Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
 - e. ASTM E136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
 - f. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.
 - g. ASTM E119 Test Methods for Fire Tests of Building Construction and Materials.

1.03 SUBMITTALS

- A. Product Data: Submit data on product characteristics, performance criteria, and limitations, including installation instructions.

1.04 QUALITY ASSURANCE

- A. Sustainable Design: Provide products which have received the following certifications:
 - 1. UL Certified Environmental Product Declaration in accordance with ISO 14025. Applies to EcoTouch® Faced and Unfaced insulation.
 - 2. GREENGUARD Formaldehyde Free, applies to EcoTouch® Unfaced and EcoTouch® Faced Batts and Rolls.
 - 3. Scientific Certification Systems SCS-MC-02676, SCS Certified minimum 58% recycled glass content (with at least 36% post-consumer recycled and the balance of pre-consumer recycled glass content), applies to EcoTouch® Faced Batts and Rolls.

1.05 DELIVERY STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original packaging.
- B. Store and protect products in accordance with manufacturer's instructions. Store in a dry indoors location. Protect insulation materials from moisture and soiling.
- C. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
- D. Do not install insulation that has been damaged or wet. Remove it from jobsite.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Owens-Corning
- B. Substitutions: See Section 01600 - Product Requirements.

2.02 MATERIALS

- A. EcoTouch® Kraft Faced Batt Insulation: ASTM C 665, Type II, Class C preformed formaldehyde free glass fiber batt type, Kraft paper faced one side.
 - 1. ICC Building Code Construction Classification: III, IV, V.

2. Perm Rating: 1 perm maximum per ASTM E96.
- B. Accessories: Provide accessories per insulating system manufacturer's recommendations, including the following:
 1. Tape: Polyethylene self-adhering type for Kraft faced insulation.

2.03 PERFORMANCE CRITERIA

- A. Metal Frame Construction, R-Value for Batt Insulation: Per ASTM C518.
 1. R-15, 3-1/2 inch thickness, 16 inch x 48 inch or 96 inch length.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine the areas and conditions under which work of this section will be installed. Verify that adjacent materials are dry and ready to receive insulation. Verify mechanical and electrical services within walls have been tested and inspected.
- B. Provide written report listing conditions detrimental to performance of work in this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 3.02 INSTALLATION

- A. Exterior Walls - Faced:
 1. Comply with manufacturer's installation instructions and ASTM C1320.
 2. Friction-fit blanket insulation in place, until the interior finish is applied. Install batts to fill entire stud cavity, with no gaps, voids, or areas of compression. If stud cavity is less than 8 feet in height, cut lengths to friction fit against floor and ceiling tracks. Walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes, and other irregularities.
 - a. Do not install insulation on top of or within 3 inches of recessed light fixtures unless the fixtures are approved for such use.
 3. Within exterior wall framing, install insulation between pipes and backside of sheathing. Cut or split insulation material as required to fit around wiring and plumbing.
 4. Fluff insulation to full thickness for specified R-value before installation. Do not compress insulation in the cavity during installation, creating gaps or voids that could diminish thermal value.
 5. Trim insulation neatly to fit spaces. Fill miscellaneous gaps and voids with insulation.
 6. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.
 7. For batt insulation with factory-applied facing, install with vapor retarder membrane facing warm in the winter side of building spaces or as specified by local building code. Lap ends and side flanges of membrane over or between framing members. Tape to seal tears, cuts or misalignments in membrane.
 8. Secure insulation in place using one of the following methods: Friction fit; staple or nail facing flanges in place as needed, tape in place, retain in place with spindle fasteners, retain in place with wire mesh secured to framing members.
- B. Above Ceiling - Unfaced:
 1. First Layer: Install parallel and between roof trusses.
 2. Second Layer: Install over and perpendicular to first layer running above bottom chord of trusses.

END OF SECTION

**SECTION 07 2103
FOAM BOARD INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at exterior walls.

1.02 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2010a.
- B. ASTM C 518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original packaging.
- B. Store and protect products in accordance with manufacturer's instructions. Store in a dry area and protect from water, direct sunlight, flame, and ignition sources. Do not install insulation that has been damaged or wet.
- C. 1. In the event the board insulation becomes wet, wipe dry prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Insulation:
 - 1. Owens Corning Corp.
 - 2. Substitutions: See Section 01600 - Product Requirements.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene Board Insulation: ASTM C 578, Type IV; Extruded polystyrene board with cut cell surfaces; with the following characteristics:
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
 - 3. Board Size: 24 x 96 inch (610 x 2440 mm).
 - 4. Board Thickness: 1.5 inch.
 - 5. Board Edges: Square.
 - 6. Thermal Conductivity (k factor) at 25 degrees F (-3.9 degrees C): 0.18 (0.31).
 - 7. Compressive Resistance: 25 psi.
 - 8. Board Density: 1.55 lb/cu ft (26 kg/cu m).
 - 9. Water Absorption, maximum: 0.3 percent, volume.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR MASONRY CAVITY WALLS

- A. Install boards horizontally on walls.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Tape insulation board joints.

3.03 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

**SECTION 07 3100
ROOFING UNDERLAYMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. High-strength polypropylene roofing underlayment.

1.02 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation and maintenance methods.
- C. Test Results: Submit copies of test results showing performance characteristics equaling or exceeding those specified.
- D. Verification Samples: For each finish product specified submit 12 inch (30.5 cm) square sample for approval by the Architect.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain primary materials from a single manufacturer regularly engaged in manufacturing building wraps. Obtain secondary materials from a source acceptable to the primary materials manufacturer.
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of two years demonstrated experience in installing products of the same type and scope as specified.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages.
- B. Store and handle in strict compliance with manufacturer's instructions and recommendations.
- C. Prevent damage or contamination to materials by construction activities.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: TYPAR, which is located at: 9335 Harris Corners Pkwy. Suite 300; Charlotte, NC 28269; Email: request info (info@typar.com); Web: www.typar.com
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 6000.
- C. Obtain products from a single manufacturer.

2.02 MATERIALS

- A. High Strength Polypropylene Roofing Underlayment: Surround SR Underlayment, a Typar Brand with the following characteristics.
- B. Basis Weight: 3.35 oz/sq.yd.
- C. Tensile Strength ASTM D 1682: MD 117 lbf CD 125 lbf.
- D. Water Vapor Transmission Rate: ASTM E 96A 0.41 perms.
- E. Components: Polypropylene with polyolefin coating.

2.03 ACCESSORIES

- A. Mechanical Fasteners: Plastic cap nails as recommended by manufacturer.
- B. Flashing: Recommended manufacturer's flashing for application type.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instruction.
- B. Sheet Materials:
 - 1. Repairs to the deck or sheathing should be completed and the area swept clean before installation. Every person working on the roof shall fully understand and comply with the safety precautions within this guide.
 - 2. In severe climates, install Surround SR Underlayment after installing a water and ice protective membrane. Install a drip edge along the eaves before applying underlayment and along the rakes after applying underlayment.
 - 3. Use 1 inch (25 mm) diameter plastic cap roofing or underlayment nails to fix Surround SR Underlayment in position. Drive nails squarely into the deck and flush with the underlayment. Staples should not be used. Using pneumatic staple guns is not recommended by manufacturer.
- C. First Course:
 - 1. Beginning at a bottom corner of the roof, lay underlayment in horizontal courses with printed side up.
 - 2. Unravel 2 or 3 feet (0.6 m to 0.9 m) of the roll and position it to be rolled across the bottom of the roof, even with the eaves with a 3/8-inch (9.5 mm) overhang.
 - 3. In critical areas where peel-n-stick ice and water shield is not along eaves or in valleys at 24 inch (610 mm) overlap is suggested.
 - 4. Maneuver into position so it covers the deck right up to the rake but not over the sides of the building. Drive plastic cap roofing nails into the top corner.
 - 5. Pull roll, straighten, and align along the eaves. Ensure there are no wrinkles. Nail at top with 1 inch (25 mm) plastic cap roofing nails spaced 8 inches (203 mm) apart. Nail middle and bottom simultaneously with a pattern of nails 24 inches (610 mm) apart.
 - 6. Roll out toward the other end of the roof and repeat the nailing pattern.
 - 7. Extend over the rake and cut with a utility knife. Trim away any excess that overhangs the rake to complete the first course of underlayment.
 - 8. Overlap ends of rolls by 6 inches (152 mm) and drive nails every 4 inches (102 mm) at overlap.
 - 9. Never walk on underlayment that is not securely nailed down.
- D. Second Course:
 - 1. Position the next course so it overlaps the first by 4 inches (102 mm). Use the white lines printed on underlayment as a guide for lining up the courses and drive nails every 4 inches (102 mm) at the overlap.
 - 2. The bottom of the second course should be on top of the first (lower) course so moisture will flow over the layers.
 - 3. Repeat the procedure of laying the first course of underlayment.
 - 4. On slopes of less than 3:12, overlap by 20 inches (508 mm).
- E. Ridge - Unvented:
 - 1. Lay in courses over the remainder of the deck.
 - 2. Lap top course at least 6 inches (152 mm) over the roof ridge.

- F. Drip Edge:
 - 1. Install drip edge along the eaves after applying adhesive membrane (if installed) before applying underlayment.
 - 2. Install along the rakes after applying under flashings.
 - 3. Shingles typically overhang the drip edge by 1 inch (25 mm) at the eaves and rake.
- G. Fasteners:
 - 1. Use plastic cap roofing nails to apply underlayment to the roof deck.
- H. Valleys Lined with Underlayment:
 - 1. Line valleys with a vertical length of underlayment down the center before applying horizontal sections of underlayment.
 - 2. Overlap sections by 20 inches (508 mm) to ensure water will run over the top of the liner.
 - 3. Cut horizontal sections at an angle as the center of the valley is reached and overlap by at least 8 inches (203 mm).
 - 4. Do not drive nails within 6 inches (152 mm) of the center line.
- I. Valley Lined with Metal Flashings: Shall be installed on roofs in applications with metal flashing, after vertical underlayment liner, before horizontal underlayment and finish coating.

3.04 PROTECTION

- A. Protect installed products until completion of project.

END OF SECTION

SECTION 07 4114
METAL ROOF PANELS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Mechanically-seamed, standing seam metal roof panels, with related metal trim and accessories.

1.02 RELATED REQUIREMENTS

- A. Division 05 Section "Cold-Formed Metal Trusses" for cold-formed metal trusses supporting metal panels.
- B. Division 07 Section "Air Barriers" for air barriers within roof assembly and adjacent to roof assembly.
- C. Division 07 Section "Sheet Metal Flashing and Trim" for formed sheet metal copings, flashings, reglets, and roof drainage items in addition to items specified in this Section.
- D. Division 07 Section "Joint Sealants" for field-applied Joint Sealants.

1.03 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org:
 - 1. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
 - 2. AAMA 809.2 - Voluntary Specification Non-Drying Sealants.
- B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International (ASTM): www.astm.org:
 - 1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 3. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 4. ASTM A 980 - Standard Specification for Steel, Sheet, Carbon, Ultra High Strength Cold Rolled.
 - 5. ASTM C 645 - Specification for Nonstructural Steel Framing Members.
 - 6. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - 7. ASTM D 1003 - Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
 - 8. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 - 9. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
 - 10. ASTM E 1514 - Standard Specification for Structural Standing Seam Steel Roof Panel Systems.
 - 11. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
 - 12. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
 - 13. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
 - 14. ASTM E 1980 - Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- D. FM Global (FM): www.fmglobal.com:

- 1. ANSI/FM 4471 - Approval Standard for Class 1 Panel Roofs.
- E. International Accreditation Service (IAS):
 - 1. IAS AC 472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems, Part B.
- F. Underwriters Laboratories, Inc. (UL): www.ul.com:
 - 1. UL 580 - Tests for Uplift Resistance of Roof Assemblies

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, manufacturer's technical representative, inspection agency and related trade contractors.
 - 1. Coordinate building framing in relation to metal panel system.
 - 2. Coordinate openings and penetrations of metal panel system.
 - 3. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.05 QUALITY ASSURANCE

- A. Manufacturer/Source: Provide metal roof panel assembly and accessories from a single manufacturer providing fixed-base roll forming, and accredited under IAS AC 472 Part B.
- B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years experience in manufacture of similar products in successful use in similar applications.
 - 1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
 - a. Product data, including certified independent test data indicating compliance with requirements.
 - b. Samples of each component.
 - c. Sample submittal from similar project.
 - d. Project references: Minimum of five installations not less than five years old, with Owner and Architect contact information.
 - e. Sample warranty.
 - f. IAS AC 472 certificate.
 - 2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
 - 3. Approved manufacturers must meet separate requirements of Submittals Article.
- C. Installer Qualifications: Experienced Installer certified by metal panel manufacturer with minimum of five years experience with successfully completed projects of a similar nature and scope.
 - 1. Installer's Field Supervisor: Experienced mechanic certified by metal panel manufacturer supervising work on site whenever work is underway.

1.06 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for specified products.
- B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, roof accessories, lightning arresting equipment, and special details. Make distinctions between factory and field assembled work.
 - 1. Indicate points of supporting structure that must coordinate with metal panel system installation.
 - 2. Include data indicating compliance with performance requirements.
 - 3. Include structural data indicating compliance with requirements of authorities having jurisdiction.

- C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.
- D. Samples for Verification: Provide 12-inch- (305 mm-) long section of each metal panel profile. Provide color chip verifying color selection.

1.07 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Indicating compliance of products with requirements, witnessed by a professional engineer.
- B. Qualification Information: For Installer firm and Installer's field supervisor.
- C. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC 472.
- D. Manufacturer's Warranty: Sample copy of manufacturer's standard warranty.

1.08 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Manufacturer's Warranty: Executed copy of manufacturer's standard warranty.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping.
 - 1. Deliver, unload, store, and erect metal panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
 - 2. Store in accordance with Manufacturer's written instructions. Provide wood collars for stacking and handling in the field.

1.10 COORDINATION

- A. Coordinate sizes, profiles, and locations of roof curbs and other roof-mounted equipment and roof penetrations, based upon sizes of actual selected equipment.

1.11 WARRANTY

- A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within one year from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design Manufacturer: MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.; Houston TX. Tel: (877)713-6224; Email: info@mbsci.com; Web: www.mbsci.com.

2.02 PERFORMANCE REQUIREMENTS

- A. General: Provide metal roof panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.
- B. System Performance: Comply with ASTM E 1514 and requirements of this Section.
- C. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated:
 - 1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
 - a. Wind Uplift Testing: Certify capacity of metal panels by actual testing of proposed assembly per ASTM E 1592.
 - 2. Snow Loads: As indicated on drawings.

3. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection required by structural documents or panel manufacturer based on project location.
 4. Seismic Performance: Comply with ASCE 7, Section 9, "Earthquake Loads."
- D. Wind Uplift Resistance: Comply with UL 580 for wind-uplift class recommended by roofing manufacturer based on code requirements for location.
- E. Air Infiltration, ASTM E 1680: Maximum 0.09 cfm/sq. ft. (0.457 L/s per sq. m) at static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
- F. Water Penetration Static Pressure, ASTM E 1646: No uncontrolled water penetration at a static pressure of 12 lbf/sq. ft. (575 Pa).
- G. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

2.03 METAL ROOF PANELS

- A. Mechanically-seamed, Concealed Fastener, Metal Roof Panels: Structural metal roof panel consisting of formed metal sheet with vertical ribs at panel edges, installed by lapping and mechanically interlocking edges of adjacent panels, and attaching panels to supports using concealed clips and fasteners in a weathertight installation.
1. Basis of Design: MBCI, SuperLok, www.mbc.com/superlok.html.
 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A 755/A 755M.
 - a. Nominal Coated Thickness: 24 gage.
 - b. Panel Surface: Smooth with striations in pan with striations in pan.
 - c. Exterior Finish: Fluoropolymer two-coat system.
 - d. Color: As selected by Architect from manufacturer's standard colors.
 3. Panel Width: 16 inches (406 mm).
 4. Panel Seam Height: 2 inch (50.8 mm).
 5. Joint Type: Mechanically seamed.

2.04 METAL ROOF PANEL ACCESSORIES

- A. General: Provide complete metal roof panel assembly incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings, in profiles as indicated. Provide required fasteners, closure strips, thermal spacers, splice plates, support plates, and sealants as indicated in manufacturer's written instructions.
- B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.
- C. Panel Clips: Provide panel clip of type specified, at spacing indicated on approved shop drawings.
 1. Two-piece Floating: ASTM C 645, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.
 2. Single-Piece Fixed: ASTM C 645, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.
- D. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by roof panel manufacturer. Where exposed fasteners cannot be avoided, supply long life fasteners with EPDM or neoprene gaskets, with heads matching color of metal panels by means of factory-applied coating.
- E. Joint Sealers: Manufacturer's standard or recommended liquid and preformed sealers and tapes, and as follows:
 1. Factory-Applied Seam Sealant: Manufacturer's standard hot-melt type.

- 2. Tape Sealers: Manufacturer's standard non-curing butyl tape, AAMA 809.2.
- F. Steel Sheet Miscellaneous Framing Components: ASTM C 645, with ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized zinc coating.
- G. Snow Guards: Approved by metal roof panel manufacturer. Refer to Section 07 "Snow Guards" for requirements for snow guards attached to metal roof panels.

2.05 FABRICATION

- A. General: Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles, and structural requirements.
- B. Fabricate metal panel joints configured to accept factory-applied sealant providing weathertight seal and preventing metal-to-metal contact and minimizing noise resulting from thermal movement.
- C. Form panels in continuous lengths for full length of detailed runs, except where otherwise indicated on approved shop drawings.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings. Form from materials matching metal panel substrate and finish.

2.06 FINISHES

- A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2.07 SPECIFIER: MBCI'S FLUOROPOLYMER COATINGS ARE BASED ON ARKEMA, INC. KYNAR 500 AND SOLVAY SOLEXIS HYLAR 500 PVF2 RESINS.

- A. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621.
 - 1. Basis of Design: MBCI, Signature 300.
- B. Interior Finish: 0.5 mil total dry film thickness consisting of primer coat and wash coat of manufacturer's standard light-colored acrylic or polyester backer finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine metal panel system substrate and supports with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panel installation.
 - 1. Inspect metal panel support substrate to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable supports at recommended spacing to match installation requirements of metal panels.
 - 2. Panel Support Tolerances: Confirm that panel supports are within tolerances acceptable to metal panel system manufacturer but not greater than the following:
 - a. 1/4 inch (6 mm) in 20 foot (6.1 m) in any direction.
 - b. 3/8 inch (9 mm) over any single roof plane.
- B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal roof panel system installation.

3.02 PREPARATION

- A. Miscellaneous Supports: Install subframing, girts, furring, and other miscellaneous panel support members according to ASTM C 754 and manufacturer's written instructions.
- B. Flashings: Install flashings to cover exposed underlayment per Section 07 62 00 "Sheet Metal Flashing and Trim."

3.03 METAL PANEL INSTALLATION

- A. Mechanically-Seamed, Standing Seam Metal Roof Panels: Install weathertight metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and

project drawings. Install metal roof panels in orientation, sizes, and locations indicated, free of waves, warps, buckles, fastening stresses, and distortions. Anchor panels and other components securely in place. Provide for thermal and structural movement.

- B. Attach panels to supports using clips, screws, fasteners, and sealants recommended by manufacturer and indicated on approved shop drawings.
 - 1. Fasten metal panels to supports with concealed clips at each location indicated on approved shop drawings, with spacing and fasteners recommended by manufacturer.
 - 2. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
 - 3. Provide weatherproof jacks for pipe and conduit penetrating metal panels of types recommended by manufacturer.
 - 4. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

3.04 ACCESSORY INSTALLATION

- A. General: Install metal panel trim, flashing, and accessories using recommended fasteners and joint sealers, with positive anchorage to building, and with weather tight mounting. Provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
 - 2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
 - 3. Provide concealed fasteners except where noted on approved shop drawings.
 - 4. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.
- B. Joint Sealers: Install joint sealers where indicated and where required for weathertight performance of metal panel assemblies, in accordance with manufacturer's written instructions.
 - 1. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.

3.06 CLEANING AND PROTECTION

- A. Remove temporary protective films immediately in accordance with metal roof panel manufacturer's instructions. Clean finished surfaces as recommended by metal roof panel manufacturer.
- B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

**SECTION 07 4213
METAL SOFFIT PANELS****PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Metal soffit panels including trim and accessories.

1.02 REFERENCES

- A. General: Standards listed by reference form a part of this specification section. Standards listed are identified by issuing authority, abbreviation, designation number, title or other designation. Standards subsequently referenced in this Section are referred to by issuing authority abbreviation and standard designation.
- B. ASTM International:
1. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 2. ASTM A 792 – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 3. ASTM A 1011 – 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.
 4. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 5. ASTM D 2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
 6. ASTM D 4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
 7. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
 8. ASTM E 283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 9. ASTM E 330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 10. ASTM E 331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- C. Underwriters Laboratories (UL):
1. UL 263 - Fire Tests of Building Construction and Materials.
- D. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): "Architectural Sheet Metal Manual."

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meetings: Conduct preinstallation meeting to clarify Project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.04 ACTION SUBMITTALS

- A. Product Technical Data: For each type of product required, including manufacturer's preparation recommendations, storage and handling requirements, and recommended installation methods.
- B. Shop Drawings: Showing methods of installation, plans, sections, elevations and details of roof and wall panels, specified loads, flashings, vents, sealants, interfaces with all materials not supplied by the metal panel system manufacturer, and identification of proposed component parts and their finishes. Do not proceed with fabrication prior to approval of shop drawings.
- C. Samples: Selection and verification samples for finishes, colors and textures. Submit two complete sample sets of each type of panel, trim, clip and fastener required.

- D. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
- E. Test and Evaluation Reports: Showing compliance with specified performance characteristics and physical properties.
- F. Qualifications Statements: For manufacturer and installer.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For installed products including maintenance methods and precautions against cleaning materials and methods detrimental to finishes and performance.
- B. Warranty: Warranty documents required in this section.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Provider of advanced installer training.
 - 2. Minimum of ten years of experience in manufacturing metal wall panel systems.
 - 3. Provider of products produced in a permanent factory environment with fixed roll-forming equipment.
- B. Installer Qualifications:
 - 1. At least five years of experience in the installation of metal wall panels.
 - 2. Experience on at least five projects of similar size, type and complexity as this Project that have been in service for a minimum of two years with satisfactory performance of the wall panel system.
 - 3. Employer of workers for this Project who are competent in techniques required by manufacturer for installation indicated and who shall be supervised at all times when material is being installed.
- C. Fire Resistance Ratings: Determined by testing identical products and assemblies according to UL 263 and ASTM E 84 by a testing agency acceptable to authorities having jurisdiction.
 - 1. Flame-Spread Index: 25 (Class A) or less.

1.07 DELIVERY, STORAGE AND HANDLING

- A. General: Comply with manufacturer's current printed product storage recommendations.
- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage: Store materials above ground, under waterproof covering, protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer. Provide proper ventilation of metal panel system to prevent condensation build-up between each panel and trim or flashing component. Tilt stack to drain in wet conditions. Remove strippable plastic film before storage under high-heat conditions. Store products in manufacturer's unopened packaging until just prior to installation.
- D. Handling: Exercise caution in unloading and handling metal panel system to prevent bending, warping, twisting and surface damage.

1.08 WARRANTY

- A. Special Exposed Panel Finish Warranty: Manufacturer's standard form PVDF Fluorocarbon System Warranty for film integrity, chalk rating and fade rating in which manufacturer agrees to repair or replace panels that show evidence of deterioration within specified warranty period.
 - 1. Deterioration shall include but is not limited to:
 - a. Color fading of more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling or failure of paint to adhere to bare metal.
 - 2. Warranty Period: Film integrity for 45 years and chalk and fade rating for 35 years from date of Substantial Completion.
 - 3. Manufacturer's warranty may exclude surface deterioration due to physical damage and exposure to salt air environments.

PART 2 PRODUCTS

2.01 METAL SOFFIT PANELS

- A. Manufacturer: Metal Sales Manufacturing Corporation
- B. 7510 Ball Road, Fort Smith, AR 72908; tel: 800.394.4419; website: www.metalsales.us.com/
- C. Basis of Design Product:
 - 1. Soffit Panel – flat, smooth.
 - 2. Soffit Panel – flat, lanced.
- D. Substitutions: See Section 01600 – Product Requirements.
- E. Product Options:
 - 1. Soffit Panel – flat, smooth.
 - a. Panel Coverage: 12 inches (304.8 mm).
 - b. Panel Depth: 1 inch (25.4 mm).
 - 2. Soffit Panel – flat, lanced.
 - a. Panel Coverage: 12 inches (304.8 mm).
 - b. Panel Depth: 1 inch (25.4 mm).
 - 3. Material: Aluminum-zinc alloy-coated steel sheet, ASTM A 792, AZ50 coating designation, structural quality, Grade 50, 0.018 inch (0.46 mm) minimum thickness.
 - 4. Finish: PVDF Kynar 500.
 - 5. Panel Fasteners: Concealed, direct fastened.
 - 6. Surface Configuration: Flat pan.
 - 7. Color: As selected by Architect from manufacturer's standard colors.
 - 8. Air Infiltration: 0.25 cfm/sq.ft. at 6.24 psf when tested according to ASTM E 283.
 - 9. Water Penetration: No penetration at 12 psf when tested according to ASTM E 331.
 - 10. Uniform Static Air Pressure Difference: Tested according to ASTM E 330.
 - 11. Code Approval: Comply with requirements of Florida Building Code construction 9482.5.

2.02 SOURCE QUALITY CONTROL

- A. Source: Obtain metal wall panels, trim and other accessories from a single manufacturer.
- B. Quality Control: Obtain metal wall panels, trim and other accessories from a manufacturer capable of providing on-site technical support and installation assistance.

PART 3 EXECUTION

3.01 METAL SOFFIT INSTALLATION

- A. General: Comply with panel manufacturer's installation instructions including but not limited to special techniques, interface with other work, and integration of systems.

3.02 ACCESSORY INSTALLATION

- A. General: Install accessories using techniques recommended by manufacturer and which will assure positive anchorage to building and weather tight mounting. Provide for thermal movement. Coordinate installation with flashings and other components.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and the SMACNA "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and install units to true level. Install work with laps, joints, and seams that will be permanently watertight.

3.03 CLEANING

- A. Remove temporary coverings and protection of adjacent work areas.
- B. Repair or replace any installed products that have been damaged.
- C. Clean installed panels in accordance with manufacturer's instructions prior to Owner's acceptance.
- D. Remove and lawfully dispose of construction debris from Project site.

3.04 PROTECTION

- A. Protect installed product and finish surfaces from damage during construction.

END OF SECTION

SECTION 07 6200
SHEET METAL FLASHING AND TRIM**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings, counter flashings and other related items in documents.

1.02 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 2012.
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels; 2002.
- C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2010.
- D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2011.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.
- F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.
- G. ASTM 8209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.
- H. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.
- I. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.
- J. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012)e1.
- K. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2003.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS**2.01 SHEET MATERIALS**

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal, shop pre-coated with modified silicone coating.

1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
 2. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 3. Color: As selected by the Architect from manufacturer's standard colors.
- B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 0.032 inch thick; plain finish shop pre-coated with modified silicone coating.
1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
 2. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
 3. Color: As selected by the Architect from manufacturer's standard colors.
- C. Stainless Steel: ASTM A666 Type 304, soft temper, 0.015 inch thick; smooth No. 4 finish.

2.02 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Underlayment: ASTM 0226, organic roofing felt, Type I ("No. 15").
- C. Primer: Zinc chromate type.
- D. Protective Backing Paint: Zinc molybdate alkyd.
- E. Sealant: Type specified in Section 07 9005.
- F. Plastic Cement: ASTM 04586, Type I.
- G. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape .

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same type sheet metal, minimum 1-1/2 inches (38 mm) wide, interlocking with sheet.
- C. Form pieces in longest possible lengths.
- D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- F. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
- G. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.
- H. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

- A. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.
- B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for field inspection requirements.
- B. Inspection may involve surveillance of work during installation to ascertain compliance with specified requirements.

3.05 SCHEDULE

- A. As detailed on Project Drawings.

END OF SECTION

**SECTION 07 7123
MANUFACTURED GUTTERS AND DOWNSPOUTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pre-finished galvanized steel gutters and downspouts.

1.02 REFERENCE STANDARDS

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- C. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on prefabricated components.

1.04 WARRANTY

- A. Complete system of gutters, downspouts, fascia, and roof trim shall be included in the twenty (20) year Weathertightness Warranty required from the Metal Roof System manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.
- B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gutters and Downspouts:
 - 1. Gutters and downspouts shall be provided and installed by roofing contractor as a part of the complete roofing system.

2.02 MATERIALS

- A. Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal.
 - 1. Finish: Shop pre-coated with PVDF (polyvinylidene fluoride) coating.
 - 2. Color: To match roof panels.

2.03 COMPONENTS

- A. Gutters: Obtain profile approval from Architect prior to beginning of work.
- B. Downspouts: Obtain profile approval from Architect prior to beginning of work.
- C. Anchors and Supports: Profiled to suit gutters and downspouts.

2.04 ACCESSORIES

2.05 FABRICATION

- A. Form gutters and downspouts of profiles and size indicated.
- B. Fabricate with required connection pieces.
- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.

- E. Fabricate gutter and downspout accessories; seal watertight.

2.06 FINISHES

- A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

- A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- C. Slope gutters ____ inch per foot (____ mm/m), ____ percent minimum.
- D. Connect downspouts to drainage system. Seal connection watertight.

END OF SECTION

**SECTION 07 9000
JOINT SEALERS**

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 1. Sealants and joint backing.
 2. Sealants at exposed concrete expansion joints and sawcut joints at interior and exterior.
 3. Pre-compressed foam sealers.

1.02 REFERENCE STANDARDS

- A. ASTM C834 - Standard Specification for Latex Sealants; 2010.
 1. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2011.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2011a.
 1. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Poly(Vinyl Chloride) Foam (Closed-Cell); 2005 (Reapproved 2011).
- D. ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness; 2005 (Reapproved 2010).
- E. BMQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; www.baaqmd.gov; current edition.
- F. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of joint sealants with cleaning of joint sealant substrates and other operations that may impact installation or finished joint sealant work.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of joint sealant product specified, including:
 1. Preparation instructions and recommendations.
 2. Standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions applicable to Project.
 3. Joint Sealant Schedule: Indicate joint sealant location, joint sealant type, manufacturer and product name, and color, for each application. Utilize joint sealant designations included in this Section.
 4. Samples for Color Selection: For each joint sealant type.
 5. Samples for Verification: For each exterior joint sealant product, for each color selected.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified applicator.
- B. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- C. Preconstruction compatibility and adhesion test reports.
- D. Preconstruction field-adhesion test reports.
- E. Field quality control adhesion test reports.
- F. Warranty: Sample of unexecuted manufacturer and installer special warranties.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced Installer equipped and trained for application of joint sealants required for this Project with record of successful completion of projects of similar scope.

- B. Single Source Responsibility: Provide exterior joint sealants by a single manufacturer responsible for testing of Project substrates to verify compatibility and adhesion of joint sealants.
- C. Preconstruction Manufacturer Laboratory Compatibility, Staining, and Adhesion Testing: Submit [four] samples of each material that will be in contact with or affect joint sealants. Test sealants with substrate materials using ASTM C794 or manufacturer's standard test methods to determine requirements for joint preparation, including cleaning and priming. Test sealants with related materials to verify compatibility.
- D. Preconstruction Field-Adhesion Testing: Prior to installing joint sealants, field test adhesion to joint substrates using ASTM C1193 Method A or method recommended by manufacturer. Verify adhesion is adequate. Modify joint preparation recommendations for failed joints and re-test. Submit written report to Architect.
- E. Mockups: Provide joint sealant application within mockups required in other sections identical to specified joint sealants and installation methods.

1.07 WARRANTY

- A. Special Installer's Warranty: Original statement on Installer's letterhead in which Installer agrees to repair or replace joint sealants that demonstrate deterioration or failure within warranty period specified.
 - 1. Warranty Period: [Two] years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Gunnable and Pourable Sealants:
 - 1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 2. Bostik Inc: www.bostik-us.com.
 - 3. Dow Corning Corporation: www.dowcorning.com.
 - 4. Hilti, Inc: www.us.hilti.com.
 - 5. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
 - 6. Pecora Corporation: www.pecora.com.
 - 7. Red Devil: www.reddevil.com.
 - 8. Tremco Global Sealants: www.tremcosealants.com.
 - 9. Sherwin-Williams Company: www.sherwin-williams.com.
 - 10. W.R. Meadows, Inc: www.wrmeadows.com.
 - 11. Substitutions: See Section 01 6000 - Product Requirements.
 - a. Silicone Sealants:
 - 1) Bostik Inc: www.bostik-us.com.
 - 2) GE Plastics: www.geplastics.com.
 - 3) Pecora Corporation: www.pecora.com.
 - 4) BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
 - b. Polyurethane Sealants:
 - 1) Bostik Inc: www.bostik-us.com.
 - 2) Pecora Corporation: www.pecora.com.
 - 3) BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
 - c. Polysulfide Sealants:
 - 1) Pecora Corporation: www.pecora.com.
 - 2) BASF Construction Chemicals-Building Systems: www.chemrex.com.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
 - d. Acrylic Sealants (ASTM C920):
 - 1) Tremco Global Sealants: www.tremcosealants.com.

- 2) Substitutions: See Section 01 6000 - Product Requirements.
- e. Butyl Sealants:
 - 1) Bostik Inc: www.bostik-us.com.
 - 2) Pecora Corporation: www.pecora.com.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- f. Acrylic Emulsion Latex Sealants:
 - 1) Bostik Inc: www.bostik-us.com.
 - 2) Pecora Corporation: www.pecora.com.
 - 3) BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- g. Preformed Compressible Foam Sealers:
 - 1) EMSEAL Joint Systems, Ltd: www.emseal.com.
 - 2) Sandell Manufacturing Company, Inc: www.sandellmfg.com.
 - 3) Dayton Superior Corporation: www.daytonsuperior.com.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.

2.02 SEALANTS - GENERAL

- A. VOC Content for Interior Applications: Provide sealants and sealant primers complying with the following VOC content limits per 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
 - 4. Compatibility: Provide joint sealants and accessory materials that are compatible with one another, and with materials in close proximity under use conditions, as demonstrated by sealant manufacturer using ASTM C1087 testing and related experience.
 - 5. Joint Sealant Standard: Comply with ASTM C 920 and other specified requirements for each liquid-applied joint sealant.
 - 6. Stain Test Characteristics: Where sealants are required to be nonstaining, provide sealants tested per ASTM C 1248 as non-staining on porous joint substrates indicated for Project.
 - 7. Food Contact Suitability: Where sealants are required to be suitable for contact with food provide sealants complying with 21 CFR 177.2600.

2.03 SEALANTS

- A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
 - 1. General Purpose Exterior Sealant: Acrylic, solvent release curing; ASTM C920, Grade NS, Class 12-1/2, Uses M, G, and A: single or multi- component.
 - a. Applications: Use for:
 - 1) Control, expansion, and soft joints in masonry.
 - 2) Joints between concrete and other materials.
 - 3) Joints between metal frames and other materials.
 - 4) Other exterior joints for which no other sealant is indicated.
 - (a) Exterior Expansion Joint Sealer: Precompressed foam sealer; urethane with water-repellent;
 - (1) Size as required to provide weathertight seal when installed.
 - (2) Provide product recommended by manufacturer for traffic-bearing use.
 - (3) Applications: Use for:
 - (4) Exterior wall expansion joints.
 - b. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
 - 1) Applications: Use for:
 - (a) Concealed sealant bead in sheet metal work.
 - (b) Concealed sealant bead in siding overlaps.

- 2) General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
 - (a) Applications: Use for:
 - (1) Interior wall and ceiling control joints.
 - (2) Joints between door and window frames and wall surfaces.
 - (3) Other interior joints for which no other type of sealant is indicated.
- c. Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
 - 1) Applications: Use for:
 - (a) Joints between plumbing fixtures and floor and wall surfaces.
 - (b) Joints between kitchen and bath countertops and wall surfaces.
- d. Acoustical Sealant for Concealed Locations:
 - 1) Composition: Permanently tacky non-hardening butyl sealant.
 - (a) Applications: Use for concealed locations only:
 - (1) Sealant bead between top stud runner and structure and between bottom stud track and floor.
 - 2) Concrete Floor Joint Filler: Self-leveling, pourable, semi-rigid sealant intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
 - (a) Composition: Polyurea or epoxy, single or multi-part, 100 percent solids by weight.
 - (1) Hardness: 75 to 80 after 7 days, when tested in accordance with ASTM 02240 Shore A.
 - (2) Joint Width: 1/8 to 1/4 inch.
 - (3) Applications: Use for:
 - (4) Control joints in concrete slabs and floors not filled with filler placed in form.
 - (5) Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.
 - (6) Color: Colors as selected by Architect.
 - (7) Applications: Use for:
 - (8) At exposed expansion joints in floors.
 - (9) At exposed sawcut Joints in interior and exterior floor slabs.
 - 3) Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C920, Class 25, Uses T, I, M and A; single component.
 - (a) Color: Color as selected.
 - (1) Applications: Use for:
 - (2) Joints in sidewalks and vehicular paving.

2.04 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine joint profiles and surfaces to determine if work is ready to receive joint sealants. Verify joint dimensions are adequate for development of sealant movement capability. Proceed with joint sealant work once conditions meet sealant manufacturer's recommendations.

3.02 PREPARATION

- A. Joint Surface Cleaning: Clean joints prior to installing joint sealants using materials and methods recommended by sealant manufacturer.
 - 1. Remove laitance, form-release agents, dust, and other contaminants.
 - 2. Clean nonporous and porous surfaces utilizing chemical cleaners acceptable to sealant manufacturer.

3.03 SEALANT APPLICATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Masking: Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.
- C. Joint Priming: Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing or experience. Apply recommended primer using sealant manufacturer's recommended application techniques.
- D. Joint Backing: Select joint backing materials recommended by sealant manufacturer to be compatible with sealant material. Install backing material at depth required to produce profile of joint sealant allowing optimal sealant movement.
 - 1. Install bond breaker tape over substrates when sealant backings are not used.
 - 2. Liquid Sealant Application: Install sealants using methods recommended by sealant manufacturer, in depths recommended for application. Apply in continuous operation from bottom to top of joint vertically and horizontally in a single direction. Apply using adequate pressure to fill and seal joint width.
 - a. Tool sealants immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.
 - b. Using tooling agents approved by sealant manufacturer for application.
 - 3. Cleaning: Remove excess sealant using materials and methods approved by sealant manufacturer that will not damage joint substrate materials.
 - a. Remove masking tape immediately after tooling joint without disturbing seal.
 - b. Remove excess sealant from surfaces while still uncured.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Steel frames for non-rated wood doors.
- B. Thermally insulated steel doors.
- C. Accessories, including glazing.

1.02 SUMMARY

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- B. ANSI A250.8 - SDI.-100 Recommended Specifications for Standard Steel Doors and Frames; 2003.
- C. ANSI A250. 10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998 (R2011).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.
- E. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.
- F. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.
- G. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 1992.
- H. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2006.
- I. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2013.
- J. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- K. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- L. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Maintain at the project site a copy of all reference standards dealing with installation.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Store in accordance with NAAMM HMMA 840.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Steel Doors and Frames:
 - 1. Assa Abloy Ceco or Curries: www.assaabloydss.com. <<http://www.assaabloydss.com/>>
 - 2. Ceco Door Products: www.cecodoor.com. <<http://www.cecodoor.com/>>
 - 3. Republic Doors: www.republi cdoor.com.
 - 4. Steelcraft: www.steelcraft.com. <<http://www.steelcraft.com/>>
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS AND FRAMES

- A. Requirements for All Doors and Frames:
 - 1. Accessibility: Comply with ANSI/ICC A117. 1.
 - 2. Door Top Closures: Flush with top of faces and edges.
 - 3. Door Edge Profile: Square edges, with no visible seam on vertical edges.
 - 4. Door Texture: Smooth faces.
 - 5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
 - 6. Hardware Preparation: In accordance with BHMA A156.1 15, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
 - 7. Finish: Factory primed, for field finishing.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 STEEL DOORS

- A. Exterior Doors :
 - 1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 2, seamless.
 - 2. Core: Polystyrene foam.
 - 3. Top Closures for Outswinging Doors: Flush with top of faces and edges.
 - 4. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
 - 5. Weatherstripping: Separate, see Section 08 7100.
 - 6. Finish: Factory primed, for field finishing.

2.04 STEEL FRAMES

- A. General:
 - 1. Comply with the requirements of grade specified for corresponding door.
 - a. ANSI A250.8 Level 3 Doors: 14 gage frames.
 - b. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage
 - c. Frames for Sound-Rated Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage
 - 2. Finish: Factory primed, for field finishing.
 - 3. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.
- B. Exterior Door Frames: Fully welded. Full height stops.
 - 1. Finish: Factory primed, for field finishing.
 - 2. Weatherstripping: Separate, see Section 08 7100.
 - 3. Non-terminated stops at exterior doors.
- C. Interior Door Frames : Fully welded type.
 - 1. Finish: Factory primed, for field finishing.

2.05 ACCESSORY MATERIALS

- A. Astragals for Double Doors: Specified in Section 08 7100.
- B. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.
 - 1. Silencers specified in Section 08 7100.
- C. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 FINISH MATERIALS

- A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.

3.02 INSTALLATION

- A. Hollow Metal Frames:
 - 1. Set frames in proper location, temporarily braced, shimmed and held in position until permanently anchored.
 - a. Properly space frame using wood template not less than 1 inch thick, that is nearly full depth of frame and of proper spacing width during setting and anchoring of frames to maintain proper width, with frame plumb and square without twists. Provide additional spreader at mid height to correct or prevent bowing of frames and secure to maintain proper opening and clearance tolerances. Remove temporary braces necessary for installation after frames have been properly set and secured.
 - b. Where frames are fabricated and shipped in sections, field splice at approved locations by welding face joint continuously or mechanical splice with recessed screws and filled. Dress smooth by grinding and filling, removing tool marks and surface imperfections.
 - c. Floor Anchors: Provide for each jamb and mullion, and secure to substrate with not less than two power-actuated fasteners or post installation screw fasteners per anchor.
 - d. Installation Tolerances: During the setting and securing of frames check and correct as necessary for opening width, opening height, squareness, alignment, twist and plumbness. Installation tolerances shall be maintained within the following limits.
 - 1) Opening Width: Measured from rabbet to rabbet at top, middle and bottom of frame; plus 1/16 inch, minus 1/32 inch.
 - 2) Opening Height: Measured vertically between the frame head rabbet and top of floor or bottom of frame minus jamb extensions at each jamb and across the head; plus 1/16 inch, minus 1/32 inch.
 - 3) Squareness: Measured at rabbet on a line from jamb, perpendicular to frame head; not to exceed 1/16 inch.
 - 4) Alignment: Measured at jambs on a horizontal line parallel to the plane of the face; not to exceed 1/16 inch.
 - 5) Twist: Measured at opposite face corners of jambs on parallel lines perpendicular to the plane of the door rabbet; not to exceed 1/16 inch.
 - 6) Plumbness: Measured at the jambs on a perpendicular line from the head to the floor; not to exceed 1/16 inch.
- B. Glazing Moldings and Stops:
 - 1. Coordinate installation with Division 08 Section - Glazing and with hollow metal manufacturer's instructions. Screw attach with stops with uniformly spaced countersunk flathead or oval head fasteners to hold stops in position tight to opening without gaps or displacement.

- C. Coordinate frame anchor placement with wall construction.

3.03 ADJUSTING

- A. Clearances Between Door and Frame: As specified in ANSI A250.8.
- B. Maximum Diagonal Distortion: 1/16 in measured with straight edge, corner to corner.

3.04 CLEANING

- A. Clean surfaces made dirty by field work.
- B. Primer Touchup: Surfaces damaged from storage, handling and installation operations shall be sanded smooth and touch up with compatible rust inhibitive primer.

END OF SECTION

**SECTION 08 1416
FLUSH WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

- A. Section 08 1113 - Hollow Metal Doors and Frames.
- B. Section 08 7100 - Door Hardware.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- B. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007 (Reapproved 2016).
- C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2014.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).
- E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).
- F. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 - 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- D. Samples: Submit two samples of door veneer, 6 by 6 inches (152.4 by 152.4 mm) in size illustrating wood grain, stain color, and sheen.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.
- G. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
 - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- D. Quality Certification:
 - 1. Provide labels or certificates indicating that installed work will comply with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 2. Provide designated labels on shop drawings as required by certification program.
 - 3. Provide designated labels on installed products as required by certification program.
 - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Eggers Industries; ____: www.eggersindustries.com/#sle.
 - 2. Graham Wood Doors; ____: www.grahamdoors.com/#sle.
 - 3. Haley Brothers; ____: www.haleybros.com/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Natural birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
 - 1. Vertical Edges: Same species as face veneer.
 - 2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet (3 m) of each other when doors are closed.
- B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- E. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. Sheen: Semigloss.
- B. Factory finish doors in accordance with approved sample.
- C. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 08 1113.
- B. Metal Louvers:
 - 1. Louver Blade: Inverted V blade, sight proof, light proof.
- C. Door Hardware: See Section 08 7100.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Install door louvers plumb and level.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum doors and frames.
- B. Weatherstripping.
- C. Door hardware.

1.02 RELATED REQUIREMENTS

- A. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- C. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
- F. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- G. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- H. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Aluminum-Framed Storefronts Manufacturers:
 - 1. Kawneer North America; _____: www.kawneer.com/#sle.
 - 2. Tubelite, Inc; _____: www.tubeliteinc.com/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BASIS OF DESIGN -- SWINGING DOORS

- A. Narrow Stile, Insulating Glazing, Thermally-Broken:
 - 1. Thickness: 1-3/4 inches (43 mm).

2.03 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Rabbet: For 1 inch (25 mm) insulating glazing - exterior doors.
 - 2. Glazing Rabbet: For 1/4 inch (6 mm) monolithic glazing - interior doors.
 - 3. Glazing Position: Centered (front to back).
 - 4. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep (50 mm wide by 114 mm deep).
 - 5. Finish: Class I natural anodized.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - 6. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 - 7. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 - 8. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 9. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 - 10. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 - 11. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Performance Requirements
 - 1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.

- a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.

2.04 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 1. Framing members for interior applications need not be thermally broken.
 2. Glazing Stops: Flush.
- B. Glazing: As specified in Section 08 8000.
- C. Swing Doors: Glazed aluminum.
 1. Thickness: 1-3/4 inches (43 mm).
 2. Top Rail: 4 inches (100 mm) wide.
 3. Vertical Stiles: 4-1/2 inches (115 mm) wide.
 4. Bottom Rail: 10 inches (254 mm) wide.
 5. Glazing Stops: Square.
 6. Finish: Same as storefront.

2.05 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- D. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.06 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.
- B. Pigmented Organic Coatings: AAMA 2603; polyester or acrylic baked enamel finish.

2.07 HARDWARE

- A. Hardware must be ADA compliant in accordance with accessibility code adopted by the State of Arkansas.
- B. For each door, include weatherstripping, sill sweep strip, and threshold.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all exterior doors.
- D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all exterior doors.
- E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all exterior doors.
- F. Pivots: Offset type; top, intermediate, and bottom.
- G. Push/Pull Set: Standard configuration handles as follows:
 1. Provide push bars and pulls on interior pair of doors (opening no. 2).
 2. Provide pulls at exterior pair of doors (opening no. 1).
- H. Exit Devices (where scheduled): Panic type.
- I. Door Closers: Exposed overhead.
 1. Provide on all doors.
- J. Locks: Dead latch.; keyed cylinder outside.
 1. Provide on exterior pair of doors (opening no. 1)..
- K. Any other standard items required by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of sealant and secure.
- J. Install hardware using templates provided.
- K. Install glass and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.
- L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.

3.06 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 5413
FIBERGLASS FIXED FRAME WINDOWS**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Fiberglass fixed frame windows.

1.02 RELATED SECTIONS

- A. Section 07 9000 - Joint Sealants: Sealants and caulking.

1.03 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 1. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.
 2. AAMA 623 - Voluntary Performance Requirements and Test Procedures for Organic Coatings on Fiber Reinforced Thermoset Profiles.
- B. American Society for Testing and Materials (ASTM):
 1. ASTM C 1036 - Flat Glass.
 2. ASTM C 1048 - Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
 3. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
 4. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
 5. ASTM E 1105 - Standard Test Method for Field Determination of Water Penetration of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- C. Window and Door Manufacturers Association (WDMA):
 1. ANSI/AAMA/NWDA 101/I.S.2 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.

1.04 PERFORMANCE REQUIREMENTS

- A. Windows shall meet Rating FW-CW-PG [manufacturer to determine based on location, use and code requirements] specifications in accordance with ANSI/AAMA/NWDA 101/I.S.2/A440-08 or ANSI/AAMA/WDMA 101/I.S.2/A440-11.
- B. Window Air Leakage, ASTM E 283: Window air leakage when tested at 1.57 psf (25 mph) shall be 0.05 cfm/ft² of frame or less.
- C. Window Water Penetration, ASTM E 547: No water penetration through window when tested under static pressure of 7.5 psf (54 mph) after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot.
- D. Factory Mullion Structural Performance (Per IBC Section 16, IBC Section 24, and AAMA 450): [Structural performance of mullions at project Design Pressure shall be validated by testing] [Deflection of mullions shall be engineered to L/175 or 3/4" max. at project design pressure (CW/AW Performance)].

1.05 SUBMITTALS

- A. Submit in accordance with Division 1 requirements.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.

- B. Storage:
 1. Store materials in accordance with manufacturer's instructions.
 2. Store materials off ground and under cover.
 3. Protect materials from weather, direct sunlight, and construction activities.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free (800) 54-PELLA. Phone (641) 621-1000. Website www.pella.com.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIBERGLASS FIXED FRAME WINDOWS

- A. Fixed Frame Windows – Basis of Design: Pella Impervia.
 1. Factory-assembled fixed frame window.
 2. Frame Material: Duracast. 5-layer, pultruded-fiberglass material, reinforced with interlocking mat.
- B. Frame:
 1. Interior and Exterior Frame: Pultruded, fiberglass composite [with foam inserts].
 2. Overall Frame Depth: 3-1/4 inches.
 3. Nominal Wall Thickness of Fiberglass Members: 0.070 inch to 0.135 inch.
 4. Frame Corners:
 - a. Mitered.
 - b. Joined and bonded with nylon corner lock, and mechanical fasteners, and injected with polyurethane adhesive sealant.
 5. Weep system at sill to channel incidental moisture to the exterior.
- C. Glazing:
- D. Float Glass: ASTM C 1036, Quality 1.
 1. Tempered Glass: ASTM C 1048.
 2. Type: Polyurethane reactive (PUR) hot-melt glazed, dual-pane 1-inch, dual-seal, tempered insulating glass, multi-layer Low-E coated with argon.

2.03 TOLERANCES

- A. Windows shall accommodate the following opening tolerances:
 1. Vertical Dimensions Between High and Low Points: Plus 1/4-inch, minus 0 inch.
 2. Width Dimensions: Plus 1/4-inch, minus 0 inch.
 3. Building Columns or Masonry Openings: Plus or minus 1/4-inch from plumb.

2.04 FINISH

- A. Exterior and Interior Duracast Finish: Factory-applied powder-coat paint, comply with AAMA 623.
 1. Color: To be selected from White, Tan, Brown, Black and Morning Sky Gray.

2.05 INSTALLATION ACCESSORIES

- A. Flashing/Sealant Tape: Pella SmartFlash.
 1. Aluminum-foil-backed butyl window and door flashing tape.
 2. Maximum Total Thickness: 0.013 inch.
 3. UV resistant.
 4. Verify sealant compatibility with sealant manufacturer.
- B. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.
- C. Exterior Perimeter Sealant: "Pella Window and Door Installation Sealant" or equivalent high quality, multi-purpose sealant as specified in the joints sealant section.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 EXAMINE AREAS TO RECEIVE WINDOWS. NOTIFY ARCHITECT OF CONDITIONS THAT WOULD ADVERSELY AFFECT INSTALLATION OR SUBSEQUENT USE. DO NOT PROCEED WITH INSTALLATION UNTIL UNSATISFACTORY CONDITIONS ARE CORRECTED.

3.03 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Install windows to be weather-tight.
- C. Maintain alignment with adjacent work.
- D. Secure assembly to framed openings, plumb and square, without distortion.
- E. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating foam sealant.
- F. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

3.04 CLEANING

- A. Clean window frames and glass in accordance with Division 1 requirements.
- B. Do not use harsh cleaning materials or methods that would damage finish or glass.
- C. Remove labels and visible markings.

3.05 PROTECTION

- A. Protect installed windows to ensure that, except for normal weathering, windows will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 08 5619
INTERIOR SLIDING PASS WINDOW

PART 1 – GENERAL

1.01 SUMMARY

- A. Section includes:
 1. Frameless interior pass-thru sliding service windows as indicated in drawings and in sections.

1.02 SUBMITTALS

- A. Submittal Procedures: See Division 01.
- B. Shop Drawings: Submit for fabrication and installation of windows. Include details, elevations and installation requirement of finish hardware and cleaning.
- C. Product Data: Submit Manufacturer's technical product data substantiating that products comply, and installation instructions.
- D. Samples: Exposed finishes. 4" (102 mm) piece of each color.
- E. Sustainable Construction Submittals: Recycled content. Identify post-consumer and pre-consumer recycled content percentage by weight.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver windows crated to provide protection during transit and job storage.
- B. Inspect windows upon delivery for damage. Unless minor defects can be made to meet the Architect's specifications and satisfaction, damaged parts should be removed and replaced.
- C. Store windows at building site under cover in dry location.
- D. Protect products from damage during handling and construction operations.

1.04 1.4 WARRANTY

- A. Warranty: All material and workmanship shall be warranted against defects for a period of one (1) year from the original date of purchase.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Header: Shall be constructed of 6063-T5 extruded aluminum. Window rolls on top-hung ball bearing rollers. Overall size is to be in accordance with the contract drawings.
- B. Finish: All aluminum to be satin anodized.
- C. Glazing: The glazing is to be ¼" (6 mm) in thickness, tempered.
- D. Options: Push button lock and recessed bottom track.
- E. Model: Sharyn (XX). X = sliding panel as viewed from clerk side.

2.02 PRODUCTS GENERAL

- A. Basis of design: Design is based on Sharyn Series Frameless Interior Pass-Thru Window manufactured by:
 1. C.R. Laurence Co., Inc. (800) 421-6144 Ext. 7760 transaction@crlaurence.com

2.03 PASS WINDOWS

- A. Pass Window Units: Factory fabricated, glazed unit; horizontal sliding type.
 1. Header: Extruded aluminum.
 2. Glass: 1/4" clear, tempered glazing.
 3. Hardware: Manufacturer's standard double track header, rollers, guides, push button lock.
 4. Unit Size: Refer to drawings.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Examine and verify substrate suitability for product installation.
- B. Verify rough opening is properly sized and located.
- C. Protect existing construction and completed work from damage.
- D. Apply barrier coating to aluminum surfaces in contact with dissimilar metals and cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.02 INSTALLATION

- A. Install window in accordance with manufacturer's printed instructions and recommendations. Repair damaged units as directed (if approved by the manufacturer and the architect) or replace with new units.

3.03 CLEANING

- A. Clean frame and glazing surfaces after installation, complying with requirements contained in the manufacturer's instructions. Remove excess glazing sealant compounds, dirt or other substances.

3.04 PROTECTION

- A. Institute protective measures required throughout the remainder of the construction period to ensure that all the windows do not incur any damage or deterioration, other than normal weathering, at the time of acceptance.

END OF SECTION

**SECTION 08 7100
DOOR HARDWARE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. All door hardware to meet ADA Accessibility Guidelines (Arkansas adopted).
- B. Hardware for wood and hollow steel doors.
- C. Key cylinders for aluminum doors.
- D. Thresholds.
- E. Weatherstripping, seals and door gaskets.
- F. Other:
 - 1. Include screws, special screws, bolts, special bolts, expansion shields, and other devices for proper application of hardware.
 - 2. If an opening is omitted from the hardware groups, provide hardware of type and quality for similar door operation.
 - 3. Includes furnishing all items of finish hardware as hereinafter specified or obviously necessary for all swinging, sliding, folding and other doors. Except items, which are specifically excluded from this section of the specification or of unique hardware, specified in the same sections as the doors and frames on which they are installed.
 - 4. Provide items, articles, materials, operations and methods listed, mentioned or scheduled herein or on drawings, in quantities as required to complete project Provide hardware that functions properly. Prior to furnishing hardware, advise Architect of items that will not operate properly, are improper for conditions, or will not remain permanently anchored.

1.02 REFERENCE STANDARDS

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council. (Arkansas Adopted Standards)
- B. ANSI A 156 - All section as applicable.
- C. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute; 2004.
- D. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; Door and Hardware Institute; 1993; also in WDHS-1/WDHS-5 Series, 1996.
- E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2010.
- F. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2012.
- G. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Confirmation letter: Confirm by letter to the Architect that all hardware meets Arkansas adopted accessibility guidelines.
- C. Shop Drawings:
 - 1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts.
- D. Samples: Prior to preparation of hardware schedule:
 - 1. Submit 1 sample of hinge, latchset, lockset, and closer illustrating style, color, and finish.
 - 2. Samples will be returned to supplier.

- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- F. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- G. Keys: Deliver with identifying tags to the owner by security shipment direct from hardware supplier.
- H. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with five years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hardware to jobsite in manufacturer's original packaging, marked to correspond with approved hardware schedule. Do not deliver hardware until suitable locked storage space is available. Check hardware against reviewed hardware schedule and lay out on shelves by hardware group. Store hardware to protect against loss, theft, or damage.
- B. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.07 COORDINATION

- A. Coordinate keying as required by the owner.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. All items, except as noted below, shall be warranted in writing by the manufacturer against failure due to defective materials and workmanship for a minimum period of one (1) year commencing on the date of final completion and acceptance. In the event of product failure, promptly repair or replace item with no additional cost to the owner.
 - 1. Mortise locksets: Five (5) years
 - 2. Exit Devices: Five (5) years
 - 3. Door closers: Ten (10) years
- C. Replace shortages and incorrect items with correct material at no additional cost to Owner.
- D. At completion of project, qualified factory representative shall inspect closer installations. After this inspection, letter shall be sent to Architect reporting on conditions, verifying that closers have been properly installed and adjusted.

1.09 MAINTENANCE SERVICE

- A. Provide special wrenches and tools applicable to each different or special hardware component.
- B. Provide maintenance tools and accessories supplied by hardware component manufacturer.
- C. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 PRODUCTS

2.01 MANUFACTURER'S LIST

- | | | |
|----|-------|--------|
| A. | Code | Name |
| | 1. HA | HAGAR |
| | 2. NO | NORTON |
| | 3. PE | PEMKO |

- 4. SA SARGENT
- 5. YA YALE SECURITY

B. ABBREVIATIONS

- 1. Alum = Clear / Mill Aluminum
- 2. DW = Door Width
- 3. DH = Door Height
- 4. DOW = Door Opening Width
- 5. DOH = Door Opening Height
- 6. TBD = To Be Determined

2.02 DOOR HARDWARE - GENERAL

- A. Provide all hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.
- B. Provide all items of a single type of the same model by the same manufacturer.
- C. Provide products that comply with the following:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide hardware that enables door assembly to comply with air leakage requirements of the applicable code.
- D. Finishes as follows:
 - 1. US 26D Satin Chrome, all hardware except items listed below.
 - 2. US 32D Satin Stainless Steel: Wall stops, push, pull and kick plates.
 - 3. Door Closers: Finish to be 689 aluminum painted.

2.03 HINGES

- A. Hinges: Provide hinges on every swinging door.
 - 1. Provide five-knuckle full mortise butt hinges unless otherwise scheduled.
 - 2. Provide hinges in the quantities indicated.
 - 3. Provide non-removable pins on exterior outswinging doors.

2.04 LOCKS AND LATCHES

- A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
 - 1. Hardware Sets indicate locking functions required for each door.
 - 2. If no hardware set is indicated for a swinging door provide an office lockset.
 - 3. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
 - 4. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.
- B. Lock Cylinders: Manufacturer's standard tumbler type, six-pin standard core.
 - 1. Provide cams and/or tailpieces as required for locking devices required.
- C. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.05 KEYING

- A. Door Locks: All cylinders and lock cores provided to have Sargent (or equal) keyway.
 - 1. Establish new master key system for this phase of construction.
 - 2. Keying of specific spaces to be determined by owner.
- B. Supply keys in the following quantities:
 - 1. 6 master keys.
 - 2. 3 change keys for each lock.
 - 3. Stamp key bows "Do not duplicate"

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of the correct characteristics.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Mounting heights for hardware from finished floor to center line of hardware item: As listed in Schedule, unless otherwise noted:
 - 1. For steel doors and frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."
 - 2. For wood doors: Comply with DHI "Recommended Locations for Architectural Hardware for Wood Flush Doors."

3.03 ADA ACCESSIBILITY GUIDELINES

- A. All hardware must meet guidelines as stated in the Americans with Disabilities Act. This includes locksets, closers, thresholds, etc.
- B. Rough-in for all hardware to be located within handicap reach limitations as outlined in the Americans with Disabilities Act.
- C. Note: Door thresholds and closers must meet ADA requirements.

3.04 FIELD QUALITY CONTROL

- A. Hardware supplier to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.05 ADJUSTING

- A. Adjust hardware for smooth operation.

3.06 PROTECTION

- A. Do not permit adjacent work to damage hardware or finish.

3.07 SCHEDULE

- A. Accessibility Compliance: All hardware, including thresholds and closers, shall meet current ANSI and Governing Accessibility Standards.
- B. Provide all corresponding and compatible strike plates and miscellaneous hardware as required.

3.08 HARDWARE SCHEDULE

- A. Set 1: Door(s) 1.
 - 1. Each To Have:
 - a. 1 ea Key Cylinder (Rim -or- Mortise as req'd).
 - b. YA 1 ea Exit Device 7000 x DW x 630
 - c. Balance of hardware by aluminum door supplier.
- B. Set 2: Door(s) 2.
 - 1. Each To Have:
 - a. 1 ea Key Cylinder (Rim -or- Mortise as req'd).
 - b. Balance of hardware by aluminum door supplier.
- C. Set 3: Door(s) 12 and 24
 - 1. Each To Have:
 - a. HA 3 ea Hinge BB1279 4 1/2" x 4 1/2" NRP US26D
 - b. YA 1 ea Exit Device 2100 x DW x 630

- | | | | | |
|----|----|------|------------------|--------------------------|
| c. | YA | 1 ea | Exit Device Trim | AU446 x 626 |
| d. | NO | 1 ea | Door Closer | 8501 x 689 |
| e. | HA | 1 ea | Kickplate | 10" x 2" less DW x US32D |
| f. | HA | 1 ea | Weatherstrip | 891SV x AL |
| g. | HA | 1 ea | Threshold | 756S x AL |
| h. | HA | 1 ea | Door Sweep | 750SN x DW x Alum |
| i. | HA | 1 ea | Wall Stop | 232W x US32D |
- D. Set 4: Door(s) 3, 4, 10 and 31.
1. Each To Have:
- | | | | | |
|----|----|------|-------------------|------------------------------|
| a. | HA | 3 ea | Hinge | BB1279 4 1/2" x 4 1/2" US26D |
| b. | YA | 1 ea | Lockset - Privacy | AU5302LN x US26D |
| c. | HA | 1 ea | Wall Stop | 232W x US32D |
| d. | HA | 3 ea | Silencers | 307D |
- E. Set 5: Door(s) 25 and 26.
1. Each To Have:
- | | | | | |
|----|----|------|---------------------|------------------------------|
| a. | HA | 6 ea | Hinge | BB1279 4 1/2" x 4 1/2" US26D |
| b. | YA | 1 ea | Lockset - Storeroom | AU5305LN x US26D |
| c. | HA | 2 ea | Flushbolts | 282D x US26D |
| d. | HA | 2 ea | Overhead Stop | 6016 x US32D |
| e. | HA | 2 ea | Silencers | 307D |
- F. Set 6: Door(s) 7, 13, 14, 17, 19, 20, 21, 28, 32 and 33.
1. Each To Have:
- | | | | | |
|----|----|------|-----------|------------------------------|
| a. | HA | 3 ea | Hinge | BB1279 4 1/2" x 4 1/2" US26D |
| b. | YA | 1 ea | Lockset | AU5307LN x US26D |
| c. | HA | 1 ea | Wall Stop | 232W x US32D |
| d. | HA | 3 ea | Silencers | 307D |
- G. Set 7: Door(s) 9, 23, 30, 34 and 35.
1. Each To Have:
- | | | | | |
|----|----|------|--------------------|------------------------------|
| a. | HA | 3 ea | Hinge | BB1279 4 1/2" x 4 1/2" US26D |
| b. | YA | 1 ea | Latchset (Passage) | AU5301LN x US26D |
| c. | HA | 1 ea | Wall Stop | 232W x US32D |
| d. | HA | 3 ea | Silencers | 307D |
- H. Set 8: Door(s) 8, 16, 18, 22 and 27
1. Each To Have:
- | | | | | |
|----|----|------|---------------------|------------------------------|
| a. | HA | 3 ea | Hinge | BB1279 4 1/2" x 4 1/2" US26D |
| b. | YA | 1 ea | Lockset - Storeroom | AU5307LN x US26D |
| c. | NO | 3 ea | Door Closer | 8501 x 689 |
| d. | HA | 3 ea | Kickplate | 10" x 2" less DW x US32D |
| e. | HA | 3 ea | Wall Stop | 232W x US32D |
| f. | HA | 3 ea | Silencers | 307D |
- I. Set 9: Door(s) 5, 6 and 29
1. Each To Have:
- | | | | | |
|----|----|------|---------------------|------------------------------|
| a. | HA | 3 ea | Hinge | BB1279 4 1/2" x 4 1/2" US26D |
| b. | YA | 1 ea | Lockset - Classroom | AU5308LN x US26D |
| c. | NO | 1 ea | Door Closer | 8501 x 689 |
| d. | HA | 1 ea | Kickplate | 10" x 2" less DW x US32D |
| e. | HA | 1 ea | Wall Stop | 232W x US32D |
| f. | HA | 3 ea | Silencers | 307D |

END OF SECTION

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. 1/4" tempered and 1" insulated glass and glazing for aluminum doors.

1.02 REFERENCES

- A. FS TT-S 1543 - Sealing Compound: Silicone Rubber Base (for Caulking, Sealing, and Glazing in Buildings and Other Structures).
- B. SIGMA No. 64-7-2 - Specification for Sealed Insulating Glass Units.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Submit sealed glass unit manufacturer's certificate indicating units meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

- A. Conform to Flat Glass Marketing Association (FGMA) Glazing Manual.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site and store and protect products in accordance with manufacturer's recommendation and Section 01 6000.

1.06 WARRANTY

- A. Provide ten year manufacturer's warranty.
- B. Warranty: Include coverage of sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. AGC Flat Glass North America, Inc.
- B. PPG Industries, Inc.
- C. Libby-Owens Ford.
- D. Substitutions: Under provisions of Section 01 6000.

2.02 GLASS MATERIALS / SCHEDULE

- A. Exterior Doors:
 - 1. 1" Tinted Insulating Safety Glass: Nominal 1" thick consisting of an exterior light of 1/4" tempered safety glass and an interior light of 1/4" clear tempered safety glass with a 1/2" air space.
 - 2. Tint Color: Gray.
 - 3. Provide Low-E coating on 2nd surface.
- B. Interior Doors:
 - 1. 1/4" Safety Glass: Nominal 1/4" thick clear, tempered glass.
- C. Glazing Compound and Setting Blocks: Type and number recommended by the manufacturer of the glazing condition.
- D. All exterior glass to have "Low E" coating on 2nd surface.

2.03 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene; 70-90 Shore A durometer hardness.
- B. Spacer Shims: Neoprene; 50 Shore A durometer hardness.

- C. Glazing Tape: Preformed Butyl Polyisobutylene compound with or without integral resilient tube spacing device; as recommended by manufacturer of tape and glass for application indicated; 10-15 Shore A durometer hardness; coiled on release paper.
- D. Glazing Gaskets: Resilient polyvinylchloride extruded shape to suit glazing requirements; black color. Refer to Section 08410 for aluminum framing system.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready for work of this Section.
- B. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses.

3.03 CLEANING

- A. After installation, mark pane with an "X" by using removable paste.
- B. Remove glazing materials from finish surfaces.
- C. Remove labels after work is completed.

END OF SECTION

**SECTION 09 1000
FINISH SCHEDULE**

REFER TO ROOM FINISH SCHEDULE ON SHEET A-4.1 IN THE SET OF DRAWINGS FOR ROOM FINISHES.

END OF SECTION

**SECTION 09 2116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal channel ceiling framing.
- C. Acoustic insulation.
- D. Gypsum wallboard.
- E. Joint treatment and accessories.

1.02 REFERENCE STANDARDS

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).
- C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (Reaffirmed 2016).
- D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.
- E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2017.
- G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2017a.
- H. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
- I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2016.
- J. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.
- K. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- L. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.
- M. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum Five years of documented experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. CertainTeed Corporation; ____: www.certainteed.com/#sle.
 - 2. Georgia-Pacific Gypsum; ____: www.gpgypsum.com/#sle.
 - 3. USG Corporation; ____: www.usg.com/#sle.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. Thickness:
 - a. Vertical Surfaces: 5/8 inch (16 mm).
 - b. Ceilings: 5/8 inch (16 mm).
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
 - 3. Moisture-Resistant Gypsum Board.
 - a. Equal to ProRoc manufactured by CerrtainTeed.
 - b. 5/8" thick.
 - c. Edge: Tapered, paper bound - factory finished.
 - d. End: Square - factory cut.

2.03 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Insulation: As specified in Division 07.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 - 1. Types: As detailed or required for finished appearance.
 - a. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
 - b. Reveal Joints: Equal to Fry Reglet Corporation REVEAL CHANNEL SCREED #DSC-625-50, 1/2" wide for 5/8" drywall. Field paint as directed by Architect.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Fiberglass Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 - 2. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
 - 3. Ready-mixed vinyl-based joint compound.
 - 4. Chemical hardening type compound.
 - 5. Joint Compound: Setting type, field-mixed.
- E. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
- C. Ceilings: Space furring members as indicated on drawings. For moisture-resistant gypsum board, space furring members 16" o.c. maximum.
- D. Studs: Space studs as indicated on drawings..
 - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 - 3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- E. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- F. Blocking: Install solid blocking for support of:
 - 1. Framed openings.
 - 2. Wall-mounted cabinets.
 - 3. Plumbing fixtures.
 - 4. Toilet partitions.
 - 5. Toilet accessories.
 - 6. Wall-mounted door hardware.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.04 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board perpendicular to framing, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long. Coordinate location with the Architect.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 3. Level 3: Walls to receive textured wall finish.
 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
- E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.07 TOLERANCES

END OF SECTION

**SECTION 09 2215
METAL FRAMING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Exterior non-load-bearing wall framing.
- B. Interior non-load-bearing wall framing.
- C. Ceiling joist framing.
- D. Soffit framing.

1.02 REFERENCE STANDARDS

- A. AISI SG-973 - Cold-Formed Steel Design Manual; American Iron and Steel Institute; latest edition.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2000.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2010.
- E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2011.
- F. ASTM A1011/A1011M - 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; 2010.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.
- H. AWS D1.3 - Structural Welding Code - Sheet Steel; American Welding Society; 2008.
- I. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).
- J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
- D. Submit shop drawings and calculations sealed and signed by a professional engineer licensed in the state of Arkansas for review prior to fabrication.
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 3. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention, and manufacturer's standard details.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.05 PROJECT CONDITIONS

- A. Verify that field measurements are as indicated on the drawings.
- B. Coordinate work of this section with the placement of components within the stud framing system.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Metal Framing, Connectors, and Accessories:
 - 1. ClarkDietrich Building Systems LLC: www.clarkdietrich.com.
 - 2. Marino: www.marinoware.com.
 - 3. Substitutions: See Section 016000 - Product Requirements.

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
- B. Metal Framing Connectors and Accessories:
 - 1. Same manufacturer as framing.
 - 2. Maximum Spacing and Layout Requirements: Exterior wall studs shall be spaced at 16 inches on center typical spacing and at 12 inches on center within 6 feet of all building corners.

2.03 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
 - 1. Gage: Non-load-bearing - 20 ga unless noted otherwise.
 - 2. Depth: As indicated on the drawings.
 - 3. Galvanized in accordance with ASTM A653/A653M G90/Z275 coating.
 - 4. Provide components fabricated from ASTM A1008/A1008M, Designation SS steel.
- B. Non-Load Bearing Studs: 3-1/2" or 6" , ASTM C-645 33 ksi yield, 20 ga., cold rolled, G-60 galvanized "C" shaped metal drywall studs, punched for utility access. Installed at 16" on center.
- C. Metal studs shall be factory pre-punched for utility access, horizontal bracing, etc. Field punching shall not be allowed.
- D. Provide lateral brace channels at mid height of all walls 9'-0" or less in height. All walls greater than 9'-0" in height shall have lateral brace channels at 4'-0" o.c. vertical a.f.f. Lateral brace channels shall be 1-1/2" x 1/2" x 16 msg C.R> channels welded or screw attached to stud with 2-1/2" x 20 ga. clip angles at 4'-0" o.c. maximum. Refer to Detail Drawing.
- E. Tracks, furring and stiffener channels shall be of the same material as the studs set in them, unless noted otherwise on drawings. ASTM C-955.
- F. Fasteners as recommended by manufacturer.
- G. Hanger Wire: 48" o.c. each way, 10 gage galvanized saddle ties minimum 16 gage.
- H. Gypsum Board Ceiling Framing System:
 - 1. 1-1/2" steel cold-rolled channels at 48" o.c.
 - 2. 7/8" hat shaped channels at 16" o.c.

2.04 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.05 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Power actuated.
- C. Welding: In conformance with AWS D1.1.

PART 3 EXECUTION**3.01 GENERAL**

- A. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Beginning of installation means acceptance of existing surfaces.
- C. Layout partitions and bulkheads in accordance with dimensions shown on the drawings.
- D. Install all materials in accordance with the manufacturer's recommendations.

3.02 INSTALLATION OF METAL STUDS

- A. Align all studs for installation of horizontal bracing thru pre-punched slot holes.
- B. Secure top and bottom tracks at 24" o.c., locating to wall and partition layout. Provide an anchor within 2" of ends and joints. Lap top runner track of metal framing 16" so both ends are anchored to adjacent studs. Protect track from damage. Align tracks accurately to the layout at base and top of studs. Secure tracks as recommended by the stud manufacturer for the type of construction involved, except do not exceed 24"o.c. spacing for nail or power driven fasteners, nor 16"o.c. for other types of attachment. Provide fasteners at corners and end of tracks.
- C. Exterior walls and partitions extending to underside of roof framing shall be secured to structure by use of manufacturer's standard slip track of same gage as studs.
- D. Extend all framing from floor to underside of roof deck where indicated on drawings. Where studs are not extended to the deck, brace the top to the structure above at 8' oc.
- E. Place studs vertically at 16" o.c., or as noted on drawings, and in direct contact with abutting walls, door frame jambs, and partition comers. All open sides to face same direction. Bottom of stud track to bear on floor. Connect all studs to track in accordance with manufacturers recommendations. Align stud web openings.
- F. Do not notch studs for installation of anchors, pipes, conduits, etc.
- G. Construct corners using three studs. Double studs at door and window jambs and ends of partitions. Anchor double and triple studs to each other. Install intermediate studs above and below openings to match wall stud spacing.
- H. Provide deflection allowance.
- I. Coordinate installation of wood blocking for attachment of fixtures, accessories, door stops, etc. Install metal framing for attachment of electrical and mechanical items.
- J. Frame all openings for passage of ducts with sill, head and jamb members.
- K. All studs shall be one piece.
- L. Check straightness of wall at floor and ceiling locations, at doors, windows, and penetrations and where framing abuts different construction.
- M. Provide a lateral brace channel above doors, windows, and openings, which extends at least 2 stud spaces beyond openings.
- N. Cutting of steel framing members may be accomplished with a saw or shear. Torch cutting of load carrying members is not permitted. Cut framing components squarely for attachment to perpendicular members or as required for an angular fit against abutting members. Hold members positively in place until fastened.

3.03 CEILING FRAMING INSTALLATION

- A. Install in accordance with U.S. Gypsum published data SA/923.

- B. Coordinate location of hangers and grid systems with other work. Verify location of recessed and suspended light fixtures prior to commencing work.
- C. Install ceiling frame independent of walls, columns, and above-ceiling work.
- D. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
- E. Laterally brace entire suspension system.
- F. Use wall board of maximum practical length to keep joints to a minimum. End joints shall be neatly fitted and staggered. Hanger wires to be 4' o.c. each way, channels, to be 48" o.c. drywall channels 16" o.c. tied or clipped to channels. 5/8" gypsum board screwed to drywall channels 12" o.c.

END OF SECTION

**SECTION 09 6520
RESILIENT WALL BASE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient wall base.

1.02 REFERENCES

- A. ASTM International:
 - 1. ASTM F 1861 Standard Specification for Resilient Wall Base
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
 - 2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials
- C. Standards Council of Canada
 - 1. CAN/ULC-S102.2 Standard Test Method for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide flooring which has been manufactured, fabricated and installed to performance criteria certified by manufacturer without defects, damage, or failure.
- B. Obtain Owner's and Consultant's acceptance of finish color.
- C. Sequencing and Scheduling
 - 1. Install wall base after the other finishing operations, including painting, have been completed.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Submit the manufacturer's standard samples showing the required colors for flooring and applicable accessories.

1.05 QUALITY ASSURANCE

- A. Single-Source Responsibility: provide types of base and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.
- B. Select an installer who is competent in the installation of resilient wall base with a minimum of 5 years experience.
 - 1. Engage installers certified from selected manufacturer.
 - 2. Confirm installer's certification by requesting their credentials
- C. Fire Performance Characteristics: Provide resilient tile flooring with the following fire performance characteristics as determined by testing material in accordance with ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:
 - 1. ASTM E 648 (NFPA 253) Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I
 - 2. ASTM E 662 (NFPA 258) (Smoke Generation) Maximum Specific Optical Density of 450 or less
 - 3. CAN/ULC-S102.2 - Flame Spread Rating and Smoke Developed - Results as tested

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Division 1 Product Requirements Sections
- B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

- C. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- D. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.07 PROJECT CONDITIONS

- A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65°F (18°C) and a maximum temperature of [100°F (38°C)][85°F (29°C)] for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55°F (13°C) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances. Refer to the manufacturer's manual for a complete guide on project conditions.

1.08 WARRANTY

- A. Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient wall base that fails within the warranty period.
- B. Limited Warranty Period: 20 years.
- C. The Limited 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.
- D. For the Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Armstrong
- B. Roppe
- C. Johnsonite
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RESILIENT WALL BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset, top set Style B, Cove and as follows:
 - 1. height: 4 inches.
 - 2. Thickness: 0.125 inch thick.
 - 3. Finish: Smooth.
 - 4. Length: Roll goods, maximum lengths only. minimum piece length is 24 inches (1 per wall).
 - 5. Color: To be selected by Architect from manufacturer's full range.
 - 6. Accessories: Pre-molded external corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive base.

3.02 INSTALLATION - WALL BASE

- A. Fit joints tightly and true vertical.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.
- E. Install straight and level to variations of plus or minus 1/8 inch over 10 feet.

3.03 CLEANING AND PROTECTION

- A. Remove excess adhesive from floor, base and wall surfaces without damage.

END OF SECTION

SECTION 09 9000
PAINTING**PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes: Surface preparation and field application of the following paint systems:
 - 1. Interior items and surfaces.
 - 2. Exterior items and surfaces.
 - 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

1.02 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for each type of product. Include surface preparation instructions, application instructions and VOC content.
 - 1. Materials List: Provide a list of required coating materials. Cross-reference each product to paint system, and locations of applications areas. Identify each material by manufacturer's catalog number. Use the same designations indicated on drawings and in schedules.
 - 2. Manufacturer's Information: Provide manufacturer's technical information, including instructions for handling, storing, and applying each coating material proposed for use.
 - 3. Color Samples:
 - a. For each paint system specified, submit samples that represent actual product, color and sheen of topcoat.
 - b. When requested by the Architect, apply a field sample of one complete coating system for each color, gloss and texture required.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with a minimum of five years documented experience.
- B. Applicator Qualifications: 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.
- C. Paint Coordination: Use block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.
- D. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this specification, comply with the more stringent provisions.
 - 1. Regulatory changes may affect the formulation, availability or use of specified coatings. Confirm availability of coatings to be used.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to job site in undamaged, original containers, bearing labels and instructions for handling, storing, and installing. The label should include manufacturer's name, product name and type, batch date, color number, VOC content, environmental handling requirements and applications instructions.
- B. Store paint materials in tightly covered containers in well-ventilated areas with a minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, as required by manufacturer's instructions.

1.05 FIELD CONDITIONS

- A. Do not apply exterior materials during fog, rain, mist, or when inclement weather is expected within the dry time specified by the manufacturer.

- B. Do not commence interior or exterior painting until the surfaces are thoroughly dry and cured. Follow the manufacturer's instructions and precautions, including testing of moisture in substrates and humidity/temperature limitations.
- C. Do not apply when air or surface temperature are below 45°F or exceed 95° F. Avoid painting surfaces in direct sunlight.
- D. During application of coating materials, post "WET PAINT" signs.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Farrell-Calhoun Paint
 - 1. 221 E. Carolina Avenue
 - 2. Memphis, TN 38126
 - 3. Phone: (901) 526-2211 www.farrellcalhoun.com
- B. Sherwin Williams.
- C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Material Quality: Provide manufacturer's best quality material of the coating types specified. Provide paints and coatings capable of being readily and uniformly dispersed to complete homogeneous mixture. Provide paints that exhibit good flow and brushing properties and are capable of drying or curing free of streaks and sags.
- B. Material Compatibility: Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- C. VOC Requirements for Untinted Base:
 - 1. Provide paints and coatings that comply with the most stringent requirements specified in Green Wise Performance Standards, Version 5.
 - a. Interior/Exterior Flat Topcoats (including Ceiling Paint and Paint & Primer in One Topcoats): =50 g/L*
 - b. Interior/Exterior Non-flat Topcoats (including Ceiling Paint and Paint & Primer in One Topcoats): =100 g/L*
 - c. Interior/Exterior Primer: =100 g/L
 - d. Interior/Exterior Anticorrosive Primers and Topcoats: =250 g/L
 - e. Interior/Exterior Clear Wood Finishes: =350 g/l
 - f. Interior/Exterior Wood and/or Concrete Floor Coatings: =100 g/L
 - g. Interior /Exterior Wood and/or Concrete Stains (Solid Color and Semi- Transparent): =250 g/L
 - h. * For VOC category determination of Flat and Non-Flat: Flat Paint gloss will be below 5 at 60 degrees or below 15 at 85 degrees. Non-Flat paint will be above or equal to 5 at 60 degrees, or above or equal to 15 at 85 degrees.
- D. Chemical Component Limitation Requirement: The following chemical compounds are not used as ingredients in the manufacture of the listed product: methylene chloride, 1,2 dichlorobenzene, phthalates, isophorone, formaldehyde, methyl ethyl ketone, methyl isobutyl ketone, and the following heavy metals: antimony, cadmium, hexavalent chromium, lead, and mercury.
- E. Colors: Provide color samples provided by manufacturer of paint system approved for use.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not begin application of coatings until substrates have been properly prepared and are ready to receive work as instructed by the product manufacturer.

- B. Examine surfaces scheduled to be finished prior to commencement of work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform on site testing to verify compatibility, adhesion and film integrity of new paint application. Report any condition that may potentially affect proper application.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Ensure that moisture-retaining substrates to receive coatings have moisture content within tolerances allowed by coating manufacturer, using moisture measurement techniques recommended by coating manufacturer. The maximum moisture content of substrates, when measured with an electronic moisture meter, are as follows.
 - 1. Concrete: 12%
 - 2. Masonry (Clay and CMU): 12%
 - 3. Wood: 15%
 - 4. Gypsum Board: 12%
 - 5. Plaster: 12%

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- B. Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not to be painted or provide surface-applied protection. Reinstall removed items upon completion of work in each area.
- C. Clean surfaces thoroughly of substances that could impair bonds such as dust, dirt, oil, and grease. Remove or repair existing primers or coatings that are incompatible or exhibit surface defects.
- D. Correct construction defects prior to coating application.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. If applicable, remove mildew from surfaces with a solution of 1 part bleach to 3 parts water. Wear required protective equipment. Scrub mildewed surface if necessary, and rinse thoroughly with clean water and allow surface to dry.
- G. Concrete and Masonry Surfaces: Remove dirt, loose mortar, scale, efflorescence, chalk, form release agents and curing compounds. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted by manufacturer's written instructions.
- H. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair. Surfaces must be completely dry and dust free before painting.
- I. Ferrous Metal Surfaces: Remove oil, grease, loose primer, mill scale and rust by the method recommended by the paint manufacturer and in accordance with SSPC Specifications for the exposure applicable to the steel use.
- J. Wood Surfaces: Remove dust, grit and foreign matter from wood surfaces. Seal knots, pitch steaks and sappy sections with sealer before applying primer. Fill nail holes, cracks and other imperfections after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

- A. Apply paint and coatings in accordance with the manufacturer's printed instructions.
- B. Use applicators and techniques best suited for the material and substrate indicated.
- C. Apply the specified number of coats and apply additional coats if required to achieve full hide and color uniformity.

- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before the next coat is applied.
- E. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

3.04 CLEANING AND PROTECTION

- A. Remove all rubbish, paint cans, and accumulated materials resulting from work in each space or room. Leave all areas in clean, orderly condition. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Carefully remove all spattering, spots and blemishes caused by work under this Section from surfaces throughout the project.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing.
- D. Touch up and repaint defects in the painted surfaces including runs, sags, misses, holidays, stains, inadequate coverage and mil thickness.

3.05 EXTERIOR PAINTING SYSTEMS

- A. Exterior Concrete Substrates, Pedestrian Traffic Surfaces
 - 1. Waterborne Floor Enamel System:
 - a. First Coat: Floor paint, acrylic urethane, matching topcoat.
 - b. Topcoat: Floor paint, acrylic urethane, satin.
 - 1) FC Tuff-Boy Waterborne Porch & Patio Satin Enamel 7500 Line
- B. Exterior Ferrous Metal Substrates
 - 1. Latex System:
 - a. Prime Coat: Primer, latex, interior/exterior.
 - 1) FC 100% Acrylic All Purpose DTM Primer 5-56
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat.
 - 1) FC 100% Acrylic Exterior Flat Latex 200 Line

3.06 INTERIOR FINISH SCHEDULE

- A. Interior Wood Substrates
 - 1. Latex System:
 - a. Prime Coat: Primer, latex, interior/exterior.
 - 1) FC Waterborne 100% Acrylic Enamel Undercoater 699
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss.
 - 1) FC 100% Acrylic Interior Semi-Gloss Latex Enamel 600 Line
 - 2) FC Evergreen Lifetime 100% Acrylic Semi-Gloss Enamel 3300
- B. Interior Gypsum Board Substrates
 - 1. Latex System:
 - a. Prime Coat: Primer, latex, interior.
 - 1) FC Perfik-Seal Latex Wall Primer/Sealer 380
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, satin.
 - 1) FC Interior Latex Satin Enamel 670 Line

END OF SECTION

SECTION 10 1400

SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Room and door signs.
- B. Building identification signs.
- C. Plaque.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- D. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- F. Manufacturer's Qualification Statement.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Room / Door Signs:
 - 1. Mohawk Sign Systems, Inc; ____: www.mohawksign.com/#sle.
 - 2. Seton Identification Products; ____: www.seton.com/aec/#sle.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Dimensional Letter Signs:
 - 1. A.R.K. Ramos Architectural Signage Systems: www.arkramos.com/#sle.
 - 2. Gemini. www.geminimade.com
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- C. Plaques:

1. A.R.K. Ramos Architectural Signage Systems; Cast Bronze Plaque:
www.arkramos.com/#sle.
2. Gemini.www.geminimade.com

2.02 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
 1. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
 2. Character Height: 1 inch (25 mm).
 3. Sign Height: As scheduled.
 4. General Sign Information: Identify with room numbers to be determined later, not the numbers indicated on drawings. Identify room name as indicated on schedule.
 5. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", or "RESTROOM" at unisex restrooms, and braille.
- C. Building Identification Signs:
 1. Use individual metal letters.
 2. Mount on outside wall in location indicated on drawings.
- D. Plaque: See Allowance for details.

2.03 SIGN TYPES

- A. Room / Door Signs: Signage media without frame.
 1. Edges: Square.
 2. Corners: Square.
 3. Wall Mounting of One-Sided Signs: Tape adhesive.
- B. Color and Font: Unless otherwise indicated:
 1. Character Font: Sans Serif.
 2. Character Case: Upper case only.
 3. Background Color: to be determined from manufacturer's color chart.
 4. Character Color: Contrasting color to be determined from manufacturer's color options.

2.04 PLAQUES

- A. Metal Plaques:
 1. Metal: Aluminum casting.
 2. Metal Thickness: 3/4 inch (____ mm), minimum.
 3. Size: 16 inches by 16 inches (____ mm by ____ mm).
 4. Text and Typeface:
 - a. Character Font: Helvetica, Arial, or other sans serif font.
 - b. Character Case: Upper case only.
 5. Border Style: As indicated on plaque design..
 6. Background Texture: Matte.
 7. Surface Finish: As selected by Architect from manufacturer's full range.
 8. Protective Coating: Manufacturer's standard clear coating.
 9. Mounting: Blind studs.

2.05 DIMENSIONAL LETTERS

- A. Metal Letters:
 1. Metal: Aluminum casting.
 2. Metal Thickness: 1/8 inch minimum (3 mm).
 3. Letter Height: 8 inches (____ mm).
 4. Text and Typeface:

- a. Character Font: Selected from manufacturer's standard fonts.
- b. Character Case: Upper and lower case (title case).
- c. Selected Letters: Randolph County Health Unit
5. Finish: As selected by Architect from manufacturer's full range.
6. Mounting: Concealed screws.

PART 3 EXECUTION

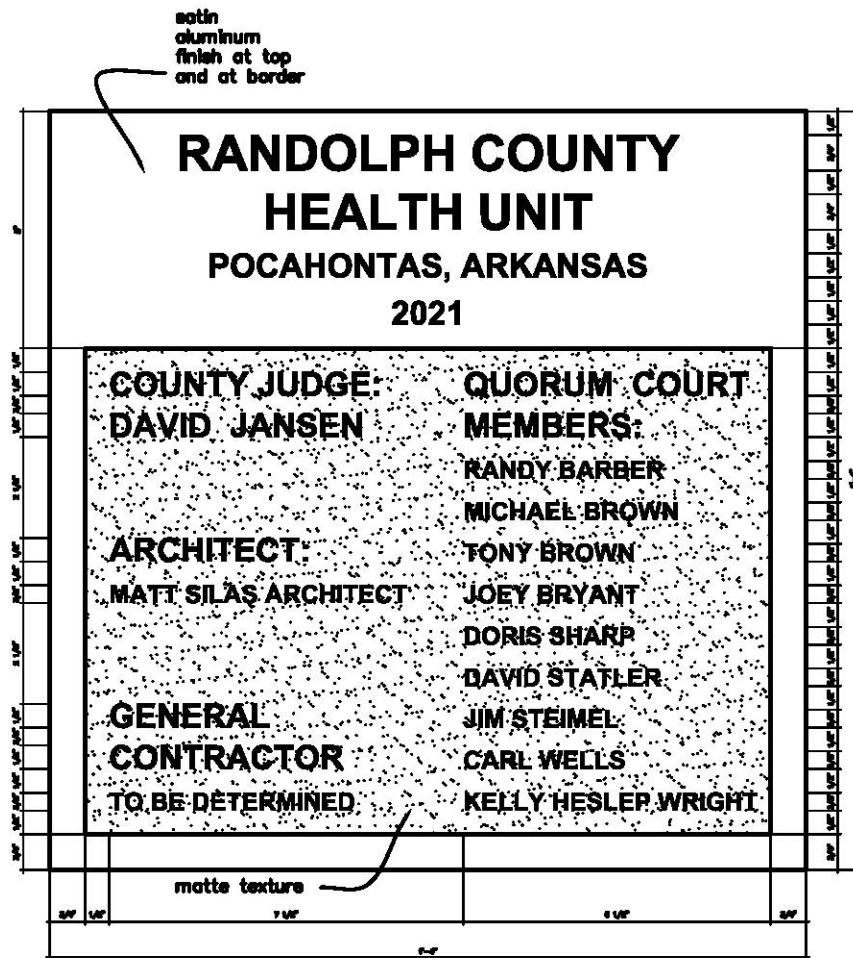
3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Provide mounting templates when applicable.
- D. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- E. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

3.02 SCHEDULE - ROOM SIGNS

- A. Doors 3 and 4.
 1. Sign equal to: Mohawk M1000.
 - a. Size: 8" x 6"
 - b. Include pictograph (MS-1 for Men and MS-2 for women), room name and braille.
- B. Doors 7, 8, 9, 13, 14, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 30, 33, 34 and 35.
 1. Sign equal to: Mohawk M1000.
 - a. Size: 6" x 6"
 - b. Include room name, room number and braille.
- C. Doors 10 and 31.
 1. Sign equal to: Mohawk M1000.
 - a. Size: 6" x 6"
 - b. Include pictograph (MS-5), room name and braille.

3.03 PLAQUE DESIGN



END OF SECTION

**SECTION 10 2601
WALL CORNER GUARDS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vinyl Corner Guards.
- B. Stainless Steel Corner guards.

1.02 1.02 SUBMITTALS

- A. Product data for each type of Corner Guard specified.
- B. Cleaning and maintenance instructions.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in unopened factory packaging to the jobsite and store in original packaging in a climate controlled location away from direct sunlight.
- B. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
- C. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.04 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Standard CAP Limited Lifetime Warranty against material and manufacturing defects.
- C. Submit supplier's written warranty against defects in material and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The Corner Guard Store / www.thecornerguardstore.com
- B. Substitutions: Section 01600 - Product Requirements.

2.02 PRODUCT

- A. General Areas:
 - 1. Textured vinyl corner guards with the following characteristics:
 - a. Size: 48" x 3" x 3"
 - b. Surface mounted 90 degree guards.

2.03 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions in which the corner guard systems will be installed.
- B. Complete all finishing operations, including painting, before beginning installation of corner guards.
- C. Wall surface shall be dry and free from dirt, grease and loose paint.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Surface must be dry, clean and properly sealed.
- C. Position corner guard 4 inches (102 mm) above finished floor or directly above wall base.
- D. Attachment as recommended by manufacturer for application.

3.03 CLEANING

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants as recommended by manufacturer.

END OF SECTION

SECTION 10 5213

FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.

1.02 REFERENCE STANDARDS

- A. NFPA 10 - Standard for Portable Fire Extinguishers; 2010.
- B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.03 PERFORMANCE REQUIREMENTS

- A. Conform to NFPA 10.
- B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate cabinet physical dimensions and wall bracket mounted measurements.
- C. Product Data: Provide extinguisher operational features.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguisher Cabinets and Accessories:
 - 1. JL Industries, Inc: www.jlindustries.com.
 - 2. Larsen's Manufacturing Co: www.larsensmfg.com.
 - 3. Substitutions: See Section 01600 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
- B. Provide fire extinguishers where located in cabinets or mounted on walls or columns designated as F.E. or F.E.C..
- C. Dry Chemical Type Fire Extinguishers: Cast steel tank, with pressure gage.
 - 1. Class A:B:C.
 - 2. Size 10.
 - 3. Finish: Baked enamel, Red color.

2.03 FIRE EXTINGUISHER CABINETS

- A. Provide fire extinguishers where located on drawings in cabinets or mounted on walls as F.E. or F.E.C. or by key symbol.
- B. JL Industries, Inc: www.jlindustries.com.

1. Fire Extinguisher: Cosmic 10E.
2. Cabinet: Fire Rated Semi-recessed, Ambassador 1017.
 - a. White Color
 - b. 3" rolled trim
 - c. Contemporary V door, white color.
 - d. 1/4" clear acrylic door glazing.
 - e. Futura "FIRE HANDLE", Red color.
 - f. Cabinet Signage: "FIRE EXTINGUISHER"

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and in compliance with accessibility standards..
- B. Install cabinets plumb and level in wall openings, 36 inches (900 mm) from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers and accessories in cabinets.
- E. See floor plans for locations.

END OF SECTION

**SECTION 10 8000
TOILET ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Accessories for toilet rooms.
- B. Grab bars.

1.02 REFERENCE STANDARDS

- A. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2010.
- B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.
- C. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2003 (Reapproved 2009).
- D. ASTM C1036 - Standard Specification for Flat Glass; 2006.
- E. GSA CID A-A-3002 - Mirrors, Glass; U.S. General Services Administration; 1996.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with the Owner for delivery of Owner provided toilet accessories for Contractor installation.
- B. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments

1.05 COORDINATION

- A. Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. See drawings for manufacturers specified.
- B. Products listed are made by Bradley.
- C. Other Acceptable Manufacturers:
 - 1. American Specialties, Inc: www.americanspecialties.com.
 - 2. Bobrick Washroom Equipment, Inc: www.bobrick.com.
 - 3. Substitutions: Section 01600 - Product Requirements.
- D. All items of each type to be made by the same manufacturer.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269, Type 304 or 316.

- D. Mirror Glass: Float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- E. Adhesive: Two component epoxy type, waterproof.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, security type.
- G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM 8456, SC 2, satin finish, unless otherwise noted.

2.04 TOILET ROOM ACCESSORIES

- A. Provide toilet accessories as scheduled on drawings.
- B. Grab Bars: Stainless steel, 1-1/4 inches (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches (38 mm) clearance between wall and inside of grab bar.
 - 1. Length and configuration: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights and Locations: As required by accessibility regulations, as indicated on drawings, and as follows:

END OF SECTION

**SECTION 12 3050
LAMINATE CLAD CASEWORK****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Laminate clad casework and components.
- B. Laminate countertops and related products.

1.02 RELATED WORK

- A. Sinks and service fixtures, service and waste lines and all connections, vents, electrical service fixtures, hoods and ducting within or adjacent to casework, or otherwise required: Furnished and installed under Mechanical and Electrical Divisions 15 and 16.
- B. Base molding: Furnished and installed under Finishes Division 9.
- C. Locks master keyed for each room. Blocking within walls where indicated.

1.03 QUALITY ASSURANCE

- A. Manufacturer will show evidence of a minimum of five (5) years experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Samples:
 - 1. Submit samples of casework manufacturer's standard decorative laminate colors, patterns and textures for exposed and semi-exposed materials for architects selection. Samples of other materials or hardware will be available if requested.
 - 2. Architect may request representative full-size samples for evaluation prior to approval. Samples may be impounded by architect/owner until completion of project to ensure compliance with specifications.
- C. Production Drawings:
 - 1. Submit CAD production drawings for casework systems, countertops, and related products showing plan view layout of units, elevations, and cross-section details.
 - 2. Coordinate production drawings with other work involved.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed; store in a ventilated place, protected from the weather, with relative humidity range of 20% to 50%.
- B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

1.06 JOB CONDITIONS

- A. Humidity and Temperature Controls:
- B. Advise contractor of requirements for maintaining heating, cooling, and ventilation in installation areas as required to reach relative humidity necessary to maintain optimum moisture content. (See Product Handling).

1.07 WARRANTY

- A. Manufacturer to provide a five year warranty to the original owner against defective material and workmanship. This is a warranty of replacement and repair only, whereby manufacturer will correct defects in material and/or workmanship without charge.

PART 2 PRODUCTS**2.01 ACCEPTABLE MANUFACTURERS**

- A. Manufacturer and Product Type:
 - 1. For purpose of determining minimum performance and quality standards this specification is based upon TMI fixed modular, casework as manufactured by TMI SYSTEMS DESIGN CORPORATION, 50 South Third Avenue West, Dickinson, North Dakota, 58601, a member of the Architectural Woodwork Institute (membership #8913) and Approved Quality Certification Program, Premium Grade.
- B. Substitutions in accordance with the provisions of Section 01 6000.

2.02 DEFINITIONS AND MATERIALS

- A. Listed are definitions and materials commonly used in defining decorative laminate clad casework. Refer to FABRICATION section for those items selected for use on this project.
- B. Definitions: Identification of casework components and related products by surface visibility.
 - 1. Open Interiors: Any open storage unit without solid door or drawer fronts and units with full glass insert doors and/or acrylic doors.
 - 2. Closed Interiors: Any closed storage unit behind solid door or drawer fronts, sliding solid doors.
 - 3. Exposed Ends: Any storage unit exterior side surface that is visible after installation.
 - a. Includes ends of units not set tight against a wall or other casework surface.
 - 4. Other Exposed Surfaces: Faces of doors and drawers when closed, and tops of cabinets less than 72" above finished floor.
 - 5. Semi-Exposed Surfaces: Interior surfaces which are visible only when doors or drawers are open, bottoms of wall cabinets and tops of cabinets 72" or more above finished floor.
 - 6. Concealed Surfaces: Any surface not visible after installation.
- C. Core Materials:
 - 1. Particleboard up to 7/8 inch thick: Industrial Grade average 47-pound density particleboard, ANSI A 208.1-2009, M-2 requirements.
 - 2. Particleboard 1 inch thick and thicker: Industrial Grade average 45-pound density particle-board, ANSI A 208.1-2009, M-2 requirements.
 - 3. Medium Density Fiberboard 1/4 inch thick: Average 54-pound density grade, ANSI A208.2-2009 requirements.
- D. Decorative Laminates: GREENGUARD Indoor Air Quality Certified
 - 1. High-pressure decorative laminate VGS (.028). NEMA Test LD 3-2005.
 - 2. High-pressure decorative laminate HGS (.048). NEMA Test LD 3-2005.
 - 3. High-pressure decorative laminate HGP (.039). NEMA Test LD 3-2005.
 - 4. High-pressure cabinet liner CLS (.020). NEMA Test LD 3-2005.
 - 5. High-pressure backer BKH (.048). (.039). (.028). NEMA Test LD3-2005.
 - 6. Thermally fused melamine TFM laminate, NEMA Test LD 3-2005. (TFM allowed on casework interiors only, as specified below. Utilization of TFM on any exterior casework surfaces, including door and drawer faces and finished ends, will not be permitted.)
- E. Laminate Color Selection:
 - 1. Selections for cabinet surfaces, grade VGS28, are selected from the current year Wilsonart®, Pionite® or Formica® complete series of offerings. A maximum of one (1) color to be selected per unit face and five (5) colors per project.
 - 2. Selections for countertop grades, HGS48 and HGP39, are selected from the current year Wilsonart®, Pionite® or Formica® complete solid and pattern offerings. A maximum of five (5) colors per project.
 - 3. Basic cabinet body color to include surfaces of all components, including drawer boxes, to be covered with thermally fused melamine laminate as a minimum requirement; drawer boxes not matching basic color will be rejected.
- F. Edging Materials:

1. 1mm PVC banding, machine applied with waterproof hot melt adhesive, only at specified locations.
2. 3mm PVC banding, machine applied with waterproof hot melt adhesive on external edges and outside corners of all countertops, and component edges and ends which can be seen when doors are both closed or open, machine profiled to 1/8" radius for safety.

2.03 SPECIALTY ITEMS

- A. Metal Parts:
1. Countertop support brackets, under-counter support frames, legs and miscellaneous metal parts are furniture steel, welded, degreased, cleaned, treated and epoxy powder coated.
 2. Flexible rail-mounted casework support rail and interfacing support keys:
 - a. Extruded aluminum 6061-T6 alloy and epoxy powder coated. Structural fasteners of rail are concealed in finished installation.
 - b. Structural integrity of the support rail and interfacing components are documented by an independent testing laboratory showing that, when tested in strict accordance with the requirements of seismic construction codes, all components meet or exceed the requirements as set forth by the codes.
 3. Structural Utility Chase Components:
 - a. All structural steel components are fabricated for dimensional consistency, welded, degreased, cleaned, treated and epoxy powder coated. The chase and all components are dimensionally integrated to align with and accommodate fixed modular or flexible rail-mounted casework and countertops.
 - b. Structural assembly will provide for mounting of closure panels, reagent ledges, rail support system, removable access panels, and field connection of services within.

2.04 CABINET HARDWARE

- A. Hinges:
1. Blum concealed clip-on style equal to #71T5580 with 120-degree swing, self-closing. Each door has a bumper to prevent laminate-to-laminate contact. Hinge has a lifetime warranty as offered by the hinge manufacturer.
- B. Door and drawer pulls are epoxy powder coated metal wire style, 96mm spacing on fasteners. Pull design is compatible with the Americans with Disability Act (ADA), Federal Register Volume 56, No. 144, specifically paragraph 4.27.4.
- C. Drawer Slides:
1. Regular use and knee space drawers are Blum Style No. BS230M and are epoxy powder coated. Slides have a 100-pound load rating at full extension and a built-in, positive stop both directions, with self-closing feature.
 2. File drawer slides are full extension, epoxy powder coated, 150-pound load rating.
 3. Pencil drawers are equipped with Blum No. BS230M.
 4. Slides have a lifetime warranty as offered by the slide manufacturer.
- D. Adjustable Shelf Supports:
1. Injection molded polycarbonate, clear color to blend with selected interior finish, friction fit into cabinet end panels and vertical dividers, readily adjustable on 32mm (approximately 1-1/4") centers. Each shelf support has two (2) integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The supports automatically adapt to 3/4" or 1" thick shelving and provide non-tip feature for shelving.
 2. Supports are designed to readily permit field fixing of shelf if desired. Structural load testing shall show loading to 1,040 pounds (260 pounds per support) without failure.
- E. Sliding Door Track:
1. Glass and wood sliding doors are anodized aluminum double channel.
- F. Coat Rods:
1. 1" diameter, 14-gauge chrome plated steel installed in captive mounting hardware.
- G. Pendaflex File Suspension Rails:

1. All file drawers include a pair of 14- gauge steel Pendaflex file suspension rails, epoxy powder coated. File followers, or other split bottom hardware, are not acceptable.

2.05 FABRICATION

- A. Fabricate casework, countertops and related products to dimensions, profiles, and details shown.
- B. Cabinet Body Construction:
 1. Tops and bottoms are joined to cabinet ends and internal cabinet components such as fixed horizontals, rails and verticals using 10mm diameter industrial grade hardwood dowels, laterally fluted with chamfered ends, securely glued and clamped under pressure during assembly to secure joints and cabinet squareness. A minimum of six (6) dowels at each joint for 24" deep cabinets and a minimum of four (4) dowels at each joint for 12" deep cabinets are used.
 2. Particleboard: Industrial grade particleboard of fir or pine meeting or exceeding ANSI A 208.1-1993, M-3 requirements.
 - a. At all sink locations, provide minimum 1" MR Moisture Resistant Particleboard, medium density average 45 pound industrial grade meeting or exceeding ANSI A 208.1, M-3 requirements.
 3. Cabinet backs are 1/4" thick prefinished hardboard. Wall and tall cabinets are provided with a 1" x 1-3/4" PVC mounting strip used to secure the cabinet to the wall. Exposed back on fixed or movable cabinets is 3/4" particleboard with the exterior surface finished in GP28 laminate as selected.
 4. All fixed under-counter and tall units have an individual factory-applied base, constructed of 3/4" A.C. Grade plywood. Base is 96 mm (nominal 4") high unless otherwise indicated on the drawings.
 5. All base units, except sink base units, are provided with a full sub-top. Sink base units are provided with open top, a split back removable access panel, and bottom panel to have CL20 high pressure cabinet liner, color to match interior color. No exceptions will be permitted.
 6. All end panels and vertical dividers are prepared to receive adjustable shelf hardware at 32mm (approximately 1-1/4") line boring centers. Door hinges, drawer slides and pull- out shelves mount in the line boring to assure consistent alignment of components.
 7. All exposed and semi exposed edges of basic cabinet components are factory edged with PVC banding, machine applied with waterproof hot melt adhesive.
 - a. Edging is 3mm PVC.
 8. Adjustable shelf core is 3/4" thick board up to 30" wide, 1" thick board over 30" wide.
 - a. Front edge is factory applied 3mm PVC.
 9. Interior Finish, Units with Open Interiors:
 - a. Sides top, bottom, horizontal, and vertical members, and adjustable shelving faced with thermally fused melamine laminate with matching prefinished back.
 10. Interior Finish, Units with Closed Interiors:
 - a. Sides top, bottom, horizontal, and vertical members, and adjustable shelving faced with thermally fused melamine laminate with matching prefinished back.
 11. Vertical and horizontal crossbar faces behind doors and drawers shall be faced on exterior side with high-pressure decorative laminate GP28 (.028) in color as selected.
 12. Exposed Ends:
 - a. Faced with high-pressure decorative laminate GP28 (.028)
 13. Wall Unit Bottom:
 - a. Faced with thermally fused melamine laminate.
 14. Wall and Tall Unit Tops:
 - a. The top edges only of wall and tall unit end panels (above 72 inches from floor) are factory edged with 1mm PVC.
 - b. Top surface laminated with thermally fused melamine laminate.

15. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), will not be permitted. No exceptions.
- C. Drawers:
1. Sides, back and sub-front are particleboard, 1/2" thick, laminated with thermally fused melamine. The back and sub front are doweled and glued into the sides. Dowels are fluted, with chamfered ends and a minimum diameter of 8mm. Top edge is banded with 1mm PVC.
 2. Drawer bottom is particleboard, 1/2" thick, laminated with thermally fused melamine, screwed directly to the bottom edges of the drawer box, to provide a rigid platform.
 - a. Drawer bottom less than 1/2" thick will not be permitted.
 3. The same 1/2" thick particleboard and platform construction detail is used for paper storage drawers and also include a PVC angle retaining bar at the rear of each drawer.
 4. Painted finishes on drawer sides and/or bottom will not be permitted.
 5. Metal box type drawer system will only be acceptable if manufacturer provides Full height box sides and ends within the drawer space height, including File Drawers. Full height is described as the top edge being within 1 inch of the top of the drawer door. The same construction type shall be used on all drawers of the entire project.
 6. Each individual drawer unit shall be manufactured with the longest drawer components possible to fit within the component depth.
- D. Door/Drawer Fronts:
1. Core for all doors and applied drawer fronts is 3/4" thick particleboard. All edges finished as indicated herein.
 2. Double doors are used on all cabinets in excess of 24" wide.
 3. Exterior faces are laminated with high-pressure decorative laminate GP28, color as selected. Interior face is high-pressure cabinet liner CL20.
 4. All door/drawer edges are finished with 3mm PVC, machine applied with waterproof hot melt adhesive. External edges and outside comers are machine profiled to 1/8" radius.
- E. Miscellaneous Shelving:
1. Core material is 3/4" or 1" board.
 2. Exterior faced with high-pressure decorative laminate, GP-28.
 3. Edges finished with 3mm PVC, machine applied with waterproof hot melt adhesive.
 4. External edges and outside corners are machine profiled to 1/8" radius.

2.06 DECORATIVE LAMINATE COUNTERTOPS

- A. Countertop core material is medium density industrial grade particleboard meeting or exceeding ANSI A 208.1-1993, M-3 requirements at all general areas. MR Moisture Resistant Particleboard, medium density, average 45 pound industrial grade meeting or exceeding ANSI A 208.1-1993, M-3 requirements at all sink areas. Thickness used is 1 inch minimum. Tight joint fasteners provided where needed.
- B. Surface material of countertops is GP48 (.048) high-pressure decorative laminate with underside properly balanced backer sheeting.
- C. All exposed edges, including edges of applied backsplash, have 3mm PVC banding, machine applied with waterproof hot melt adhesive. Exposed edges and comers are machine profiled to 1/8" radius for safety.

PART 3 EXECUTION

3.01 EXAMINATION

- A. The installer must examine the job site and the conditions under which the work under this section is to be performed, and notify the contractor in writing of unsatisfactory conditions. Do not proceed with work under this Section until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 PREPARATION

- A. Condition casework to average prevailing humidity conditions in installation areas prior to installing.

3.03 INSTALLATION

- A. Install casework with factory-trained supervision authorized by manufacturer. Erect casework, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.
- B. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.04 CLEANING AND PROTECTION

- A. Repair or remove and replace defective work as directed upon completion of installation.
- B. Clean plastic surfaces, repair minor damage per plastic laminate manufacturer's recommendations. Replace other damaged parts or units.
- C. Advise contractor of procedures and precautions for protection of casework and tops from damage by other trades until acceptance of the work by the owner.

END OF SECTION

SECTION 22 0500

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Sleeves.
 - 5. Escutcheons.
 - 6. Grout.
 - 7. Equipment installation requirements common to equipment sections.
 - 8. Concrete bases.
 - 9. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing 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 chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

- A. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
 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.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- F. 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.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Stainless steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated and rough brass.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. 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.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing 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 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

SECTION 22 0513

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.

- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers:
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 22 0519

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bimetallic-actuated thermometers.
 - 2. Liquid-in-glass thermometers.
 - 3. Thermowells.
 - 4. Dial-type pressure gages.
 - 5. Gage attachments.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product certificates.
- C. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Standard: ASME B40.200.
- B. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.
- C. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.
- D. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.
- E. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- F. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- G. Window: Plain glass.
- H. Ring: Stainless steel.
- I. Element: Bimetal coil.
- J. Pointer: Dark-colored metal.
- K. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 1. Standard: ASME B40.200.
 2. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
 3. Case Form: Adjustable angle unless otherwise indicated.
 4. Tube: Glass with magnifying lens and blue or red organic liquid.
 5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
 6. Window: Glass.
 7. Stem: Aluminum and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
 8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
 9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

- A. Thermowells:
 1. Standard: ASME B40.200.
 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 3. Material for Use with Copper Tubing: CNR or CUNI.
 4. Material for Use with Steel Piping: CRES.
 5. Type: Stepped shank unless straight or tapered shank is indicated.
 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
 7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
 8. Bore: Diameter required to match thermometer bulb or stem.
 9. Insertion Length: Length required to match thermometer bulb or stem.
 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
 1. Standard: ASME B40.100.
 2. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
 3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 4. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 5. Movement: Mechanical, with link to pressure element and connection to pointer.
 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
 7. Pointer: Dark-colored metal.
 8. Window: Glass.
 9. Ring: Stainless steel.
 10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
 - 2. Inlets and outlets of each domestic water heat exchanger.
 - 3. Inlet and outlet of each domestic hot-water storage tank.
- I. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.
 - 3. Suction and discharge of each domestic water pump.
- J. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- K. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
 - 1. Liquid-filled, bimetallic-actuated type.
- B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be the following:
 - 1. Liquid-filled, bimetallic-actuated type.

- C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be the following:
 - 1. Liquid-filled, bimetallic-actuated type.
- D. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

3.4 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at discharge of each water service into building shall be the following:
 - 1. Liquid-filled, direct-mounted, metal case.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:
 - 1. Liquid-filled, direct-mounted, metal case.
- C. Pressure gages at suction and discharge of each domestic water pump shall be the following:
 - 1. Liquid-filled, direct-mounted, metal case.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping: 0 to 100 psi.
- B. Scale Range for Domestic Water Piping: 0 to 100 psi.

END OF SECTION

SECTION 22 0523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Iron, single-flange butterfly valves.
4. Bronze swing check valves.
5. Iron swing check valves.
6. Iron swing check valves with closure control.
7. Bronze gate valves.
8. Iron gate valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.

- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.

- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With rising stem.
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 3. Butterfly Valves: With extended neck.

- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

- A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.3 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Aluminum bronze.

B. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Nickel-plated or -coated ductile iron.

2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE or TFE.

2.6 IRON SWING CHECK VALVES

- A. Class 125, Iron Swing Check Valves with Metal Seats:
 - 1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.

2.7 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

- A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:
 - 1. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.
 - h. Closure Control: Factory-installed, exterior lever and spring.

2.8 BRONZE GATE VALVES

- A. Class 125, NRS Bronze Gate Valves:
 - 1. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

2.9 IRON GATE VALVES

- A. Class 125, NRS, Iron Gate Valves:
 - 1. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig.

- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Disc: Solid wedge.
- g. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.2 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, or gate valves.
 - 2. Throttling Service: Ball valves.
 - 3. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 2. Bronze Angle Valves: Class 125, bronze disc.
 3. Ball Valves: Two piece, full port, brass or bronze with bronze trim.
 4. Bronze Swing Check Valves: Class 125, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
 3. Iron Swing Check Valves: Class 125, metal seats.
 4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
 5. Iron Gate Valves: Class 125, NRS.

3.5 SANITARY-WASTE VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 2. Ball Valves: Two piece, full port, brass or bronze with bronze trim.
 3. Bronze Swing Check Valves: Class 125, bronze disc.
 4. Bronze Gate Valves: Class 125, NRS.
- B. Pipe NPS 2-1/2 and Larger:
 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 2. Iron Swing Check Valves: Class 125, metal seats.
 3. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
 4. Iron Gate Valves: Class 125, NRS.

END OF SECTION

SECTION 22 0529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Equipment supports.
- B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
- C. See Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
- D. See Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes 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.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. 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. Equipment supports.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 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. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- C. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 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.

2.3 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig-minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.
- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.

- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type 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.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.7 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, 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.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- 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.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, 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 for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F 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-joint 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. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

- 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 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. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 - 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 - 3. 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.
- 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 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. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:

1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- M. 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 B31.9 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.
 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 5. Pipes NPS 8 and Larger: Include wood 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.

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.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 22 0548

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Elastomeric hangers.
 - 2. Spring hangers.
 - 3. Spring hangers with vertical-limit stops.
 - 4. Pipe riser resilient supports.
 - 5. Resilient pipe guides.
 - 6. Restraining braces and cables.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Design in accordance with conditions expected for the job site at Pocahontas, Arkansas. Acceleration and forces shall be equal to those expected at the job site location.

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Qualification Data: For professional engineer.
- D. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent

testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. California Dynamics Corporation.
 - 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 4. Hilti, Inc.
 - 5. Kinetics Noise Control.
 - 6. Loos & Co.; Cableware Division.
 - 7. Mason Industries.
 - 8. TOLCO Incorporated; a brand of NIBCO INC.
 - 9. Unistrut; Tyco International, Ltd.

- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

- D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

- F. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

- G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

- H. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment Restraints:
 - 1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches.
 - 2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- G. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Domestic Water Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 22 0553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.

1.2 SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch or Aluminum, 0.032-inch 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.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 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 thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black.
 - 3. Background Color: White.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets or self-tapping screws.

- 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- 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 bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. 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 high.

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 along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
 1. Domestic Water Piping:
 - a. Background Color: Blue.
 - b. Letter Color: White.
 2. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: White.
 - b. Letter Color: Black.

END OF SECTION

SECTION 22 0700

PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Cellular glass.
 - b. Flexible elastomeric.
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied fabric-reinforcing mesh.
8. Field-applied jackets.
9. Tapes.
10. Securements.
11. Corner angles.

B. Related Sections include the following:

1. Division 23 Section "HVAC Insulation."

1.2 SUBMITTALS

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

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. 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, tapes, 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.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Block Insulation: ASTM C 552, Type I.
 - 2. Special-Shaped Insulation: ASTM C 552, Type III.
 - 3. Board Insulation: ASTM C 552, Type IV.
 - 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 6. 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.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 200 deg F.
 - 3. Solids Content: 63 percent by volume and 73 percent by weight.
 - 4. Color: White.

2.5 SEALANTS

- A. Joint Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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.
4. Color: Aluminum.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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.
4. Color: White.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
5. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
6. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.8 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
- B. Insulation Pins and Hangers:
 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - b. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.

2.9 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at 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 Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

- A. 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.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, 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.

3.6 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.

3.7 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.

3.8 FINISHES

- A. Equipment and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.

- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

- D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- B. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 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. Domestic water, domestic chilled-water (potable), and domestic hot-water hydropneumatic tank insulation shall be the following:
 1. Flexible Elastomeric: 1 inch thick.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold, Hot, Recirculated Hot Water, and Condensate: Insulation shall be one of the following:
 1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Chilled Water (Potable): Insulation shall be one of the following:
 1. Flexible Elastomeric: 1 inch thick.
 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

- C. Stormwater and Overflow: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

- D. Roof Drain and Overflow Drain Bodies: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

- E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

- F. Sanitary Waste Piping Where Heat Tracing Is Installed: Insulation shall be the following:
 - 1. Cellular Glass: 2 inches thick.

3.13 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

- A. Loose-fill insulation, for belowground piping, is specified in Division 33 piping distribution Sections.

- B. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

3.14 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

SECTION 22 1116
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.
4. Escutcheons.
5. Sleeves and sleeve seals.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. 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. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
 - 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.5 TRANSITION FITTINGS

- A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- B. Sleeve-Type Transition Coupling: AWWA C219.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:

- 1. Description:
 - a. Pressure Rating: 150 psig at 180 deg F.
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

- 1. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 150 psig.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

- 1. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

- 1. Description:
 - a. Galvanized-steel coupling.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Female threaded.
 - d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:

- 1. Description:
 - a. Electroplated steel nipple complying with ASTM F 1545.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

2.7 FLEXIBLE CONNECTORS

- A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.8 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.
- C. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

2.9 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with setscrews.

2.10 SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Stainless steel.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.11 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install domestic water piping level and plumb.
- F. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Install piping adjacent to equipment and specialties to allow service and maintenance.
- K. Install piping to permit valve servicing.
- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.
- O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- P. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

- Q. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.
- R. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. 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 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball

valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 to NPS 6: Use dielectric flange kits.

3.7 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.
- C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.

- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.9 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; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 - 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.10 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
 - 5. Bare Piping in Equipment Rooms: One piece, cast brass.
 - 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
- C. Escutcheons for Existing Piping:
 - 1. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - 2. Insulated Piping: Split plate, stamped steel with concealed hinge and spring clips.
 - 3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
 - 4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
 - 5. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish.
 - 6. Bare Piping in Equipment Rooms: Split casting, cast brass.
 - 7. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

3.11 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.

- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
 - c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
 - 4. Sleeves for Piping Passing through Concrete Roof Slabs: Steel pipe.
 - 5. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
 - c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.12 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.13 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.14 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
 - 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 one day 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 tests or inspections, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
 - 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 a 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 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 for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.15 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

- a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. 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.

3.16 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and brazed joints.
- D. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought- copper solder-joint fittings; and brazed joints.
- E. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought- copper solder-joint fittings; and soldered joints.
- F. Aboveground domestic water piping, NPS 5 and NPS 6, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought- copper solder-joint fittings; and soldered joints.

3.17 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.

2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

SECTION 22 1119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Balancing valves.
 - 4. Temperature-actuated water mixing valves.
 - 5. Strainers.
 - 6. Hose bibbs.
 - 7. Water hammer arresters.
 - 8. Trap-seal primer valves.

- B. See Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Standard: ASSE 1001.
 - 2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 3. Body: Bronze.
 - 4. Inlet and Outlet Connections: Threaded.
 - 5. Finish: Rough bronze.

- B. Hose-Connection Vacuum Breakers:
 - 1. Standard: ASSE 1001.
 - 2. Body: Bronze, nonremovable, with manual drain.
 - 3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 - 4. Finish: Chrome or nickel plated.

2.2 BACKFLOW PREVENTERS

- A. Intermediate Atmospheric-Vent Backflow Preventers:
 - 1. Standard: ASSE 1012.
 - 2. Operation: Continuous-pressure applications.
 - 3. Size: NPS 3/4.
 - 4. Body: Bronze.
 - 5. End Connections: Union, solder joint.
 - 6. Finish: Chrome plated.

- B. Reduced-Pressure-Principle Backflow Preventers:
 - 1. Standard: ASSE 1013.
 - 2. Operation: Continuous-pressure applications.
 - 3. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
 - 4. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

- C. Double-Check Backflow-Prevention Assemblies:
 - 1. Standard: ASSE 1015.
 - 2. Operation: Continuous-pressure applications, unless otherwise indicated.
 - 3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
 - 4. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

D. Backflow-Preventer Test Kits:

1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 2 or smaller.
4. Body: Copper alloy.
5. Port: Standard or full port.
6. Ball: Chrome-plated brass.
7. Seats and Seals: Replaceable.
8. End Connections: Solder joint or threaded.
9. Handle: Vinyl-covered steel with memory-setting device.

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig.
3. Type: Thermostatically controlled water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

B. Primary, Thermostatic, Water Mixing Valves:

1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig.
3. Material: Bronze body with corrosion-resistant interior components.
4. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
5. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
 - c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.6 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Include operating key with each operating-key hose bibb.
13. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.7 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.8 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Standard: ASSE 1018.
2. Pressure Rating: 125 psig minimum.
3. Body: Bronze.
4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" 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 balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install thermometers and water regulators if specified.
 - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- E. Install Y-pattern strainers for water on supply side of each control valve and pump.
- F. Install water hammer arresters in water piping according to PDI-WH 201.
- G. Install supply-type, 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.
- H. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- I. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Intermediate atmospheric-vent backflow preventers.
 - 2. Reduced-pressure-principle backflow preventers.
 - 3. Double-check backflow-prevention assemblies.
 - 4. Primary, thermostatic, water mixing valves.
 - 5. Supply-type, trap-seal primer valves.
- J. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

SECTION 22 1316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following storm drainage, soil and waste, sanitary drainage and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.2 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.

1.3 SUBMITTALS

- A. Field quality-control inspection and test reports.

1.4 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; and "NSF-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

- a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
- C. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
 - 1. Drainage Fittings: ASME B16.12, threaded, cast-iron drainage pattern.
 - 2. Pressure Fittings:
 - a. 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.
 - b. 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.
 - c. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.
 - d. Cast-Iron Flanges: ASME B16.1, Class 125.
 - e. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125.
- D. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.
- E. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
 - 2. Solvent Cement and Adhesive Primer:
 - a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, storm, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, hub-and-spigot, 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. Steel pipe, drainage fittings, and threaded joints.
 4. Copper DWV tube, copper drainage fittings, and soldered joints.
- D. Aboveground, storm, soil, waste, and vent piping NPS 5 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. Steel pipe, drainage fittings, and threaded joints.
 4. Copper DWV tube, copper drainage fittings, and soldered joints.
- E. Underground, storm, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- F. Underground, storm, soil and waste Piping NPS 5 and larger shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.2 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- 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 22 Section "Common Work Results for Plumbing."
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."
- 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."
- F. Make changes in direction for storm, 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 storm, soil, and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Storm and Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Storm and 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. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- J. Install PVC storm, soil, and waste drainage and vent piping according to ASTM D 2665.
- K. Install underground PVC storm, soil, and waste drainage piping according to ASTM D 2321.
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- 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.
- D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 VALVE INSTALLATION

- A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Use gate or full-port ball valve for piping NPS 2 and smaller.
 - 2. Use gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Backwater valves are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." 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 and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron storm and soil piping with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. NPS 6: 60 inches with 3/4-inch rod.
 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron storm and soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 3. NPS 2: 10 feet with 3/8-inch rod.
 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 5. NPS 3: 12 feet with 1/2-inch rod.
 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.

- 7. NPS 6: 12 feet with 3/4-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 5. NPS 6: 10 feet with 5/8-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.
- L. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 - 4. NPS 6: 48 inches with 3/4-inch rod.
- M. Install supports for vertical PVC piping every 48 inches.
- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. 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. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
 - 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. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
 - 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 and larger.

3.7 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.
1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 2. Prepare reports for tests and required corrective action.

3.8 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.

3.9 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

SECTION 22 1319

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Backwater valves.
 - 2. Cleanouts.
 - 3. Floor drains.
 - 4. Roof flashing assemblies.
 - 5. Miscellaneous sanitary drainage piping specialties.
 - 6. Flashing materials.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

- A. Horizontal, Cast-Iron Backwater Valves:
 - 1. Standard: ASME A112.14.1.
 - 2. Size: Same as connected piping.
 - 3. Body: Cast iron.
 - 4. Cover: Cast iron with bolted or threaded access check valve.
 - 5. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.2 CLEANOUTS

- A. Exposed Cast-Iron Cleanouts:
 - 1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 2. Size: Same as connected drainage piping

- B. Cast-Iron Floor Cleanouts:
 - 1. Standard: ASME A112.36.2M for adjustable housing cleanout.
 - 2. Size: Same as connected branch.
 - 3. Body or Ferrule: Cast iron.

- C. Cast-Iron Wall Cleanouts:
 - 1. Standard: ASME A112.36.2M. Include wall access.
 - 2. Size: Same as connected drainage piping.

2.3 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
 - 1. Standard: ASME A112.6.3.

2.4 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:
- B. Description: Manufactured assembly made of 4.0-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. Open-Top Vent Cap: Without cap.
 - 2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 - 3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Open Drains:
 - 1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
- B. Deep-Seal Traps:
 - 1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
 - 2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch-minimum water seal.
 - b. NPS 2-1/2 and Larger: 6-inch-minimum water seal.
- C. Floor-Drain, Trap-Seal Primer Fittings:
 - 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 - 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

- D. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 2. Body: Bronze or cast iron.
 3. Inlet: Opening in top of body.
 4. Outlet: Larger than inlet.
 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

2.6 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. 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.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. 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 or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 - 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.
- G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- I. Assemble open drain fittings and install with top of hub 1 inch above floor.
- J. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- K. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- L. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- M. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- N. Install vent caps on each vent pipe passing through roof.
- O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- P. 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 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- 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, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors 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 07 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.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 3300

ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial, electric, storage, domestic-water heaters.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 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."

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: For commercial domestic-water heaters, accessories, and components, from manufacturer.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Three years.
 - 2) Controls and Other Components: Three years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1. Standard: UL 1453.
 - 2. Storage-Tank Construction: ASME-code, steel vertical arrangement.
 - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Pressure Rating: 150 psig.
 - c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.
 - 3. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.

- c. Insulation: Comply with ASHRAE/IESNA 90.1.
- d. Jacket: Steel with enameled finish.
- e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
- f. Temperature Control: Adjustable thermostat.
- g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
- h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

- A. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- C. Heat-Trap Fittings: ASHRAE 90.2.
- D. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig-maximum outlet pressure unless otherwise indicated.
- E. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- F. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.
- G. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- H. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.
- I. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.
- J. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

- B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases.
 - 1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 8. Anchor domestic-water heaters to substrate.
- B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves.
- C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices.
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric,

domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves.

- G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers.
- H. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- I. Fill electric, domestic-water heaters with water.
- J. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

- A. Comply with requirements for piping. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

END OF SECTION 223300

SECTION 22 4000
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Faucets for lavatories and sinks.
 - 2. Toilet seats.
 - 3. Protective shielding guards.
 - 4. Fixture supports.
 - 5. Water closets.
 - 6. Lavatories.
 - 7. Kitchen sinks.
 - 8. Service sinks.

- B. Related Sections include the following:
 - 1. Division 22 Section "Water Coolers."

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. FRP: Fiberglass-reinforced plastic.
- D. PMMA: Polymethyl methacrylate (acrylic) plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

1.4 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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
 - 3. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
 - 4. Stainless-Steel Residential Sinks: ASME A112.19.3.
 - 5. Vitreous-China Fixtures: ASME A112.19.2M.
 - 6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
 - 7. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- G. 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. Faucets: ASME A112.18.1.
 - 5. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 6. Hose-Coupling Threads: ASME B1.20.7.
 - 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 8. NSF Potable-Water Materials: NSF 61.
 - 9. Pipe Threads: ASME B1.20.1.
 - 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 - 11. Supply Fittings: ASME A112.18.1.
 - 12. Brass Waste Fittings: ASME A112.18.2.
- H. 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 A112.18.1.
 - 3. Manual-Operation Flushometers: ASSE 1037.
 - 4. Plastic Tubular Fittings: ASTM F 409.
 - 5. Brass Waste Fittings: ASME A112.18.2.
 - 6. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

- I. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Disposers: ASSE 1008 and UL 430.
 - 2. Flexible Water Connectors: ASME A112.18.6.
 - 3. Grab Bars: ASTM F 446.
 - 4. Hose-Coupling Threads: ASME B1.20.7.
 - 5. Off-Floor Fixture Supports: ASME A112.6.1M.
 - 6. Pipe Threads: ASME B1.20.1.
 - 7. Plastic Toilet Seats: ANSI Z124.5.
 - 8. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

- A. Certain manufacturers identification numbers have been used to indicate a standard of quality. All products by other manufacturers as indicated by subsequent paragraphs of this section are acceptable, subject to submittal review and Engineer approval process.
- B. Plumbing fixtures and related items shall be a complete unit ready for installation as set forth in the drawing schedule.

2.2 LAVATORY FAUCETS

- A. Lavatory Faucets:
 - 1. Faucets shall be as specified or equal by T and S Brass and Bronze Works, Kohler, American Standard, Chicago Faucet Company.
 - 2. See fixture schedule on drawings.

2.3 SINK FAUCETS

- A. Sink Faucets:
 - 1. Faucets shall be as specified or equal by T and S Brass and Bronze Works, Kohler, American Standard, Chicago Faucet Company.
 - 2. See fixture schedule on drawings.

2.4 TOILET SEATS

- A. Toilet Seats:
 - 1. Description: Toilet seat for water-closet-type fixture.
 - 2. Shall be by Centoco, Church, Kohler, Beneke, or Bemis.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.6 FIXTURE SUPPORTS

A. Lavatory Supports:

1. Description: Type for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.7 WATER CLOSETS

A. Water Closets:

1. Shall be by American Standard or approved equal by Kohler, Crane, Toto or Eljer.
2. See fixture schedule on drawings.

2.8 LAVATORIES

A. Lavatories:

1. Shall be by American Standard or approved equal by Kohler, Crane, Toto or Eljer.
2. See fixture schedule on drawings.

2.9 KITCHEN SINKS

A. Kitchen Sinks:

1. Shall be by Elkay or Just.
2. See fixture schedule on drawings.

2.10 SERVICE SINKS

A. Service Sinks:

1. See fixture schedule on drawings.

2.11 CAULKING

- A. Caulking shall be by General Electric silicon sanitary sealant or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 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-mounting 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-mounting fixtures with tubular waste piping attached to supports.
- F. Install fixtures level and plumb according to roughing-in drawings.
- G. 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.
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- J. 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.
- K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- L. Install toilet seats on water closets.
- M. 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.
- N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- O. 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.
- P. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.

- Q. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- R. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing 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.

3.4 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 4700

WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wall-mounting water coolers.
 - 2. Fixture supports.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

1.3 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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants" for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

PART 2 - PRODUCTS

2.1 WATER COOLERS

- A. Water Coolers:
 - 1. Description: Accessible, ARI 1010, wall-mounting water cooler.
 - a. Cabinet: Bilevel with two attached cabinets and with bilevel skirt kit, all stainless steel.
 - b. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
 - c. Supply: NPS 3/8 with ball or gate valve.
 - d. Drain(s): Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.1.
 - e. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
 - f. Support: Type II, water cooler carrier. Refer to "Fixture Supports" Article.

2.2 FIXTURE SUPPORTS

- A. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
 - 1. Type I: Hanger-type carrier with two vertical uprights.
 - 2. Type II: Bilevel, hanger-type carrier with three vertical uprights.
 - 3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
- B. Set freestanding and pedestal drinking fountains on floor.
- C. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view.

3.2 INSTALLATION

- A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.
- B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily

reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.
 - 2. Report test results in writing.

3.5 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

END OF SECTION

23 0513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
 2. Split phase.
 3. Capacitor start, inductor run.
 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

23 0529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Equipment supports.
- B. See Section 230548 – Vibration and Seismic Controls for HVAC for seismic bracing requirements.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. 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.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

- b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
- 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint 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. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

- P. Use powder-actuated fasteners instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 23 0548

VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Open-spring isolators.
 - 5. Housed-spring isolators.
 - 6. Restrained-spring isolators.
 - 7. Housed-restrained-spring isolators.
 - 8. Pipe-riser resilient supports.
 - 9. Resilient pipe guides.
 - 10. Elastomeric hangers.
 - 11. Spring hangers.
 - 12. Snubbers.
 - 13. Restraint channel bracings.
 - 14. Restraint cables.
 - 15. Seismic-restraint accessories.
 - 16. Mechanical anchor bolts.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
 - 1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer registered in this State responsible for their preparation.

1.3 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based

on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: D.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: III.
 - a. Component Importance Factor: 1.5.
 - b. Component Response Modification Factor: See sheet S100.
 - c. Component Amplification Factor: See sheet S100.
 - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): See sheet S100.
 - 4. Design Spectral Response Acceleration at 1.0-Second Period: See sheet S100.
- B. Wind Speed: 120 MPH is Vult. 93 MPH is Vasd. Wind risk category is III. Wind exposure is C.

2.2 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads: See AHU detail.
 - 1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 - 2. Size: Factory or field cut to match requirements of supported equipment.
 - 3. Pad Material: Oil and water resistant with elastomeric properties.
 - 4. Surface Pattern: Waffle pattern.

2.3 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

- A. Restrained Elastomeric Isolation Mounts: for Exhaust Fans.
 - 1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - a. Housing: Cast-ductile iron or welded steel.
 - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 HOUSED-RESTRAINED-SPRING ISOLATORS

- A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing: ERV-1
 - 1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

- a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.5 PIPE-RISER RESILIENT SUPPORT

- A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene as needed for Natural Gas Piping.
 1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
 2. Maximum Load Per Support: 500 psigon isolation material providing equal isolation in all directions.

2.6 RESILIENT PIPE GUIDES

- A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene as needed for Natural Gas Piping.
 1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.7 ELASTOMERIC HANGERS

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods: as needed for Natural Gas Piping.
 1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.8 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression: as needed for Natural Gas Piping.
 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.9 SNUBBERS

- A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

2.10 RESTRAINT CHANNEL BRACINGS

- A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.11 RESTRAINT CABLES

- A. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.12 SEISMIC-RESTRAINT ACCESSORIES

- A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- B. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- C. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- D. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

- E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Cast-in-Place Concrete.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Comply with requirements in "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- D. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- E. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- F. Install cables so they do not bend across edges of adjacent equipment or building structure.
- G. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

- H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- K. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 23 2113 "Hydronic Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.

- 8. Verify snubber minimum clearances.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION

23 0553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.

1.2 SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black.
 - 3. Background Color: White.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 7. Fasteners: Stainless-steel rivets.
 - 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

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.

END OF SECTION

23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.2 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.

1.3 INFORMATIONAL SUBMITTALS

- A. Certified TAB reports.

1.4 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.
- B. 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.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

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 system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- F. Examine test reports specified in individual system and equipment Sections.
- G. 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.
- H. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- I. Examine operating safety interlocks and controls on HVAC equipment.
- J. 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. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.

4. Isolating and balancing valves are open and control valves are operational.
5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. 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" and in this Section.
 1. Comply with requirements in ASHRAE 62.1, 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. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 0713 "Duct Insulation," Section 23 0716 "HVAC Equipment Insulation," Section 23 0719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 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. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.

- K. Verify that air duct system is sealed as specified in Section 23 3113 "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 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 TOLERANCES

- A. Set HVAC system's air flow rates 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.

3.9 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.

3.10 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. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. 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 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. Duct, outlet, and inlet sizes.
 - 3. Position of balancing devices.

3.11 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.

END OF SECTION

SECTION 23 0713

DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - 6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
 - 7. Outdoor, concealed supply and return.
 - 8. Outdoor, exposed supply and return.

- B. Related Sections:
 - 1. Section 23 0719 "HVAC Piping Insulation."
 - 2. Section 23 3113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

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

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Fire- and water-resistant, flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 4. Color: Aluminum.

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

2.7 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. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
1. Sheet and roll stock ready for shop or field sizing.
 2. Finish and thickness are indicated in field-applied jacket schedules.
- D. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

2.8 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 3 inches.
 2. Thickness: 6.5 mils.
 3. Adhesion: 90 ounces force/inch in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.9 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020-inch-thick, 3/4-inch-wide with wing seal or closed seal.

- B. Insulation Pins and Hangers:
 - 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

 - 2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - b. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

 - 3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.

 - 4. 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.

 - 5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

- D. Wire: 0.080-inch nickel-copper alloy.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

- a. For below ambient services, apply vapor-barrier mastic over staples.
- 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

- a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. 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.

3.6 FINISHES

- A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - 6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
 - 7. Outdoor, concealed supply and return.
 - 8. 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.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. ft. nominal density.
- B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. ft. nominal density.

- C. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 3 inches thick and 0.75-lb/cu. ft. nominal density.
- D. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. ft. nominal density.
- E. Exposed, Supply-Air Duct and Plenum Insulation: Shall be lined with 1" liner.
- F. Exposed, Return-Air Duct and Plenum Insulation: Shall be lined with 1" liner.
- G. Exposed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 0.75-lb/cu. ft. nominal density.

3.10 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. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 0.75-lb/cu. ft. nominal density.
- C. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 0.75-lb/cu. ft. nominal density.

3.11 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. None.
 - 2. Aluminum, Smooth: 0.020 inch thick.
- D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
 - 1. Aluminum, Smooth: 0.020 inch thick.
- E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. Aluminum, Smooth with 1-1/4-Inch-Deep Corrugations: 0.032 inch thick.

END OF SECTION

SECTION 23 0719

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
 - 1. Section 23 0713 "Duct Insulation."

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at pipe expansion joints for each type of insulation.
 - 3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 4. Detail removable insulation at piping specialties.
 - 5. Detail application of field-applied jackets.
 - 6. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. 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.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
 - 1. Block Insulation: ASTM C 552, Type I.
 - 2. Special-Shaped Insulation: ASTM C 552, Type III.
 - 3. Board Insulation: ASTM C 552, Type IV.
 - 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- D. PVC Jacket Adhesive: Compatible with PVC jacket.

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.4 SEALANTS

- A. Joint Sealants:
 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 2. Permanently flexible, elastomeric sealant.
 3. Service Temperature Range: Minus 100 to plus 300 deg F.
 4. Color: White or gray.

- 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.
 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.
 4. Color: White.

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
 5. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 6. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Adhesive: As recommended by jacket material manufacturer.
 - 2. Color: Color-code jackets based on system. Color as selected by Architect.
 - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - 1. Sheet and roll stock ready for shop or field sizing.
 - 2. Finish and thickness are indicated in field-applied jacket schedules.
 - 3. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
 - 4. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - 5. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- E. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.
- F. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
- G. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

- H. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

2.8 TAPES

- A. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches.
 - 2. Thickness: 3.7 mils.
 - 3. Adhesion: 100 ounces force/inch in width.
 - 4. Elongation: 5 percent.
 - 5. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Wire: 0.080-inch nickel-copper alloy.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.

- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.

6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 1. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached

insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- B. 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.

- C. Where PVDC jackets are indicated, install as follows:
1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch-overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.7 FINISHES

- A. Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric, 1 inch thick.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be the following:
 - 1. Flexible Elastomeric: 2 inches thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be the following:
 - 1. Flexible Elastomeric: 2 inches thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
 - 1. PVC, Color-Coded by System: 20 mils thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. None.
- D. Piping, Exposed:
 - 1. PVC: 20 mils thick.

END OF SECTION

SECTION 23 2300
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Refrigerant pipes and fittings.
 - 2. Refrigerant piping valves and specialties.
 - 3. Refrigerants.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.
- B. Shop Drawings:
 - 1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
 - 2. Show interface and spatial relationships between piping and equipment.
 - 3. Shop Drawing Scale: 1/4 inch equals 1 foot.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-134a:
 - 1. Suction Lines for Air-Conditioning Applications: 115 psig.
 - 2. Suction Lines for Heat-Pump Applications: 225 psig.
 - 3. Hot-Gas and Liquid Lines: 225 psig.

- B. Line Test Pressure for Refrigerant R-407C:
 - 1. Suction Lines for Air-Conditioning Applications: 230 psig.
 - 2. Suction Lines for Heat-Pump Applications: 380 psig.
 - 3. Hot-Gas and Liquid Lines: 380 psig.

- C. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 535 psig.
 - 3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or L.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8/A5.8M.
- F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
 - 4. Working Pressure Rating: Factory test at minimum 500 psig.
 - 5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
 - 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
 - 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
 - 3. Operator: Rising stem and hand wheel.

4. Seat: Nylon.
 5. End Connections: Socket, union, or flanged.
 6. Working Pressure Rating: 500 psig.
 7. Maximum Operating Temperature: 275 deg F.
- B. Packed-Angle Valves:
1. Body and Bonnet: Forged brass or cast bronze.
 2. Packing: Molded stem, back seating, and replaceable under pressure.
 3. Operator: Rising stem.
 4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
 5. Seal Cap: Forged-brass or valox hex cap.
 6. End Connections: Socket, union, threaded, or flanged.
 7. Working Pressure Rating: 500 psig.
 8. Maximum Operating Temperature: 275 deg F.
- C. Check Valves:
1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
 2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
 3. Piston: Removable polytetrafluoroethylene seat.
 4. Closing Spring: Stainless steel.
 5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
 6. End Connections: Socket, union, threaded, or flanged.
 7. Maximum Opening Pressure: 0.50 psig.
 8. Working Pressure Rating: 500 psig.
 9. Maximum Operating Temperature: 275 deg F.
- D. Service Valves:
1. Body: Forged brass with brass cap including key end to remove core.
 2. Core: Removable ball-type check valve with stainless-steel spring.
 3. Seat: Polytetrafluoroethylene.
 4. End Connections: Copper spring.
 5. Working Pressure Rating: 500 psig.
- E. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
 2. Screen: 100-mesh stainless steel.
 3. End Connections: Socket or flare.
 4. Working Pressure Rating: 500 psig.
 5. Maximum Operating Temperature: 275 deg F.
- F. Angle-Type Strainers:
1. Body: Forged brass or cast bronze.
 2. Drain Plug: Brass hex plug.
 3. Screen: 100-mesh monel.
 4. End Connections: Socket or flare.
 5. Working Pressure Rating: 500 psig.
 6. Maximum Operating Temperature: 275 deg F.
- G. Moisture/Liquid Indicators:
1. Body: Forged brass.
 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 3. Indicator: Color coded to show moisture content in parts per million (ppm).
 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 5. End Connections: Socket or flare.
 6. Working Pressure Rating: 500 psig.

- 7. Maximum Operating Temperature: 240 deg F.

- H. Replaceable-Core Filter Dryers: Comply with AHRI 730.
 - 1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 - 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - 3. Desiccant Media: Activated alumina.
 - 4. End Connections: Socket.
 - 5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
 - 6. Maximum Pressure Loss: 2 psig.
 - 7. Working Pressure Rating: 500 psig.
 - 8. Maximum Operating Temperature: 240 deg F.

- I. Permanent Filter Dryers: Comply with AHRI 730.
 - 1. Body and Cover: Painted-steel shell.
 - 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - 3. Desiccant Media: Activated alumina.
 - 4. End Connections: Socket.
 - 5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
 - 6. Maximum Pressure Loss: 2 psig.
 - 7. Working Pressure Rating: 500 psig.
 - 8. Maximum Operating Temperature: 240 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-407C

- A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

- B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

- C. Safety-Relief-Valve Discharge Piping: Copper, Type K, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

- B. Hot-Gas and Liquid Lines: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

- C. Hot-Gas and Liquid Lines: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

- D. Hot-Gas and Liquid Lines: Copper, Type K, drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.

- E. Hot-Gas and Liquid Lines: Copper, Type K, drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- F. Safety-Relief-Valve Discharge Piping: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- G. Safety-Relief-Valve Discharge Piping: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.3 VALVE AND SPECIALTY APPLICATIONS

- A. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- B. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- C. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
- D. Install a full-size, three-valve bypass around filter dryers.
- E. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- F. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - 1. Install valve so diaphragm case is warmer than bulb.
 - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- G. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- I. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:
 - 1. Solenoid valves.
 - 2. Thermostatic expansion valves.
 - 3. Hot-gas bypass valves.
 - 4. Compressor.
- J. Install filter dryers in liquid line between compressor and thermostatic expansion valve.
- K. Install receivers sized to accommodate pump-down charge.
- L. Install flexible connectors at compressors.

3.4 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Section 23 0923 "Direct Digital Control (DDC) System for HVAC" and Section 23 0993.11 "Sequence of Operations for HVAC DDC" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08 3113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- O. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

- Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- R. Identify refrigerant piping and valves according to Section 23 0553 "Identification for HVAC Piping and Equipment."
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 0517 "Sleeves and Sleeve Seals for HVAC Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 0517 "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 0518 "Escutcheons for HVAC Piping."

3.5 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.6 HANGERS AND SUPPORTS

- A. Comply with requirements for pipe hangers and supports specified in Section 23 0529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.

4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod, 1/2 inch.

D. Support multifloor vertical runs at least at each floor.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.8 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.9 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
 2. Verify that compressor oil level is correct.
 3. Open compressor suction and discharge valves.
 4. Open refrigerant valves except bypass valves that are used for other purposes.
 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 23 3113

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.
6. Seismic-restraint devices.

B. Related Sections:

1. Section 23 0593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 23 3300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ANSI/ASHRAE 62.1.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.

4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
 - a. Luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 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 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 3 inches.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 7. Service: Indoor and outdoor.

8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel 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.

2.6 SEISMIC-RESTRAINT DEVICES

- A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- B. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- C. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- D. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

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 ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 23 3300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
 - 1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 2. Brace a change of direction longer than 12 feet.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.

- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 23 3300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 START UP

- A. Air Balance: Comply with requirements in Section 23 0593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

- A. Supply Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 1-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

- B. Return Ducts:
 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.

- C. Exhaust Ducts:
 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

- D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 1-inch wg.
 - b. Minimum SMACNA Seal Class: C.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 24.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

- 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
- 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
- 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
- 4) Radius-to Diameter Ratio: 1.5.

- b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
- c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 3300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Flange connectors.
7. Turning vanes.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Duct accessory hardware.

B. Related Requirements:

1. Section 23 3723 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Section 28 3111 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.2 ACTION SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- C. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Description: Gravity balanced.
- B. Maximum Air Velocity: 1250 fpm.
- C. Maximum System Pressure: 2-inch wg.
- D. Frame: Hat-shaped, 0.05-inch-thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.
- E. Blades: Multiple single-piece blades, off-center pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.
- F. Blade Action: Parallel.
- G. Blade Seals: Neoprene, mechanically locked.
- H. Blade Axles:
 - 1. Material: Nonferrous metal.
 - 2. Diameter: 0.20 inch.
- I. Tie Bars and Brackets: Aluminum.
- J. Return Spring: Adjustable tension.
- K. Bearings: Steel ball or synthetic pivot bushings.
- L. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators.
 - 4. Chain pulls.
 - 5. Screen Mounting: Front mounted in sleeve.

- a. Sleeve Thickness: 20 gage minimum.
- b. Sleeve Length: 6 inches minimum.
- 6. Screen Material: Galvanized steel.
- 7. Screen Type: Bird.
- 8. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Standard leakage rating, with linkage outside airstream.
 - 2. Suitable for horizontal or vertical applications.
 - 3. Frames:
 - a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 4. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
 - 5. Blade Axles: Galvanized steel.
 - 6. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 7. Tie Bars and Brackets: Galvanized steel.
- B. Jackshaft:
 - 1. Size: 0.5-inch diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- C. Damper Hardware:
 - 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 - 2. Include center hole to suit damper operating-rod size.
 - 3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

- A. Frames:
 - 1. Hat shaped.

2. 0.094-inch-thick, galvanized sheet steel.
 3. Mitered and welded corners.
- B. Blades:
1. Multiple blade with maximum blade width of 6 inches.
 2. Parallel- and opposed-blade design.
 3. Galvanized-steel.
 4. 0.064 inch thick single skin or 0.0747-inch-thick dual skin.
 5. Blade Edging: Closed-cell neoprene.
 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- C. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- D. Bearings:
1. Oil-impregnated bronze.
 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

- A. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
- B. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- C. Fire Rating: 1-1/2 and 3 hours.
- D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 1. Minimum Thickness: 0.05, 0.138 inch or 0.39 inch thick, as indicated, and of length to suit application.
 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 0.024-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- I. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.7 SMOKE DAMPERS

- A. General Requirements: Label according to UL 555S by an NRTL.
- B. Smoke Detector: Integral, factory wired for single-point connection.
- C. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded corners.
- D. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel.
- E. Leakage: Class II.
- F. Mounting Sleeve: Factory-installed, 0.039-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
- G. Damper Motors: Modulating or two-position action.
- H. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 0513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 23 0923 "Direct Digital Control (DDC) System for HVAC"
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. 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 and breakaway torque rating of 150 in. x lbf.
 - 5. Outdoor Motors and Motors in Outdoor-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.
 - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 - 7. Electrical Connection: 115 V, single phase, 60 Hz.
- I. Accessories:
 - 1. Auxiliary switches for signaling.
 - 2. Momentary test switch , damper mounted.

2.8 FLANGE CONNECTORS

- A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- B. Material: Galvanized steel.
- C. Gage and Shape: Match connecting ductwork.

2.9 TURNING VANES

- A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall.

2.10 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 - 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

2.11 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..

2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 3. Service Temperature: Minus 40 to plus 200 deg F.
- E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd..
 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 3. Service Temperature: Minus 50 to plus 250 deg F.

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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
1. Install steel volume dampers in steel ducts.
 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
1. On both sides of duct coils.

2. Upstream from duct filters.
 3. At outdoor-air intakes and mixed-air plenums.
 4. At drain pans and seals.
 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 7. At each change in direction and at maximum 50-foot spacing.
 8. Upstream from turning vanes.
 9. Upstream or downstream from duct silencers.
 10. Control devices requiring inspection.
 11. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
 2. Two-Hand Access: 12 by 6 inches.
 3. Head and Hand Access: 18 by 10 inches.
 4. Head and Shoulders Access: 21 by 14 inches.
 5. Body Access: 25 by 14 inches.
 6. Body plus Ladder Access: 25 by 17 inches.
- K. Label access doors according to Section 23 0553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- N. Connect diffusers or light troffer boots to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- O. Connect flexible ducts to metal ducts with draw bands.
- P. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation.

END OF SECTION

SECTION 23 3423

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ceiling-mounted ventilators.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
 - 3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - 4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED VENTILATORS

- A. Housing: Steel, lined with acoustical insulation.
- B. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

- C. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- D. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- E. Accessories:
 - 1. See Fan Schedule.
- F. Capacities and Characteristics:
 - 1. See Fan Schedule.

2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 0513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation and seismic control devices specified in Section 23 0548 "Vibration and Seismic Controls for HVAC."
- B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section 07 7200 "Roof Accessories" for installation of roof curbs.
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Section 23 0553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 3300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.

- C. Comply with requirements in Section 23 0593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION

23 3713
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Perforated diffusers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 REGISTERS AND GRILLES, CEILING DIFFUSERS

- 1. Equal to scheduled products.

2.2 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 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.

3.2 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 3723

HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roof hoods.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- B. Seismic Performance: Ventilators, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 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."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.
- C. Delegated-Design Submittal: For shop-fabricated ventilators 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 shop-fabricated ventilators.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For ventilators, accessories, and components, from manufacturer.

1.5 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.
- D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
 - 2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
- E. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

- A. Factory fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.
- D. Fabricate supports, anchorages, and accessories required for complete assembly.

2.3 ROOF HOODS

- A. Factory fabricated according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 6-6 and 6-7.

- B. Materials: Galvanized-steel sheet, minimum 0.064-inch-thick base and 0.040-inch-thick hood; suitably reinforced.
- C. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.
 - 1. Configuration: Self-flashing without a cant strip, with mounting flange.
 - 2. Overall Height: 14 inches.
- D. Bird Screening: Galvanized-steel, 1/2-inch-square mesh, 0.041-inch wire.
- E. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.
- F. Galvanized-Steel Sheet Finish:
 - 1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
- G. Capacities and Characteristics:
 - 1. See Air Distribution Schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Secure gravity ventilators to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible. Refer to Section 07 7200 "Roof Accessories."
- C. Install gravity ventilators with clearances for service and maintenance.
- D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 07 9200 "Joint Sealants" for sealants applied during installation.
- F. Label gravity ventilators according to requirements specified in Section 23 0553 "Identification for HVAC Piping and Equipment."
- G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

END OF SECTION

23 8126

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes split-system air-conditioning.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

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:
 - a. For Compressor: Five year(s) from date of Substantial Completion.

- b. For Parts: One year(s) from date of Substantial Completion.
- c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Carrier Corporation; a unit of United Technologies Corp.
 - 2. Coleman Company Inc. (The).
 - 3. Lennox Industries, Inc.; Lennox International.
 - 4. Luxaire Corporation; a division of the Unitary Products Group of Luxaire; a Johnson Controls Company.
 - 5. Trane.
 - 6. YORK; a Johnson Controls company.

2.2 INDOOR UNITS

- A. Casing:
 - 1. Shall be constructed of zinc coated, heavy gauge, galvanized steel with exterior surfaces cleaned, phosphatized and finished baked enamel. Casing insulated with cleanable, foil faced, fire retardant glass fiber material with all insulation edges sealed.
 - 2. Provide knockouts for electrical power and refrigerant piping.
 - 3. Captive screws shall be on all access panels.
- B. Refrigeration System:
 - 1. Dual refrigeration circuits each controlled by a factory installed thermal expansion valve.
 - 2. Coils aluminum fin bonded to 3/8" internally enhanced copper tubing leak tested at 375 psig. Coil in draw through configuration with double sloped condensate drain pan of PVC plastic and removable for cleaning.
 - 3. Coil casing shall be zinc coated, heavy gauge, galvanized steel, insulated, convertible, aluminum fins mechanically bonded to 3/8" OD copper tubing.
- C. Evaporator Fan:
 - 1. Double inlet, double width, forward curved, centrifugal fans with adjustable belt drive. Thermal overload protection. Permanently lubricated bearings.
- D. Controls:
 - 1. Magnetic evaporator fan contractor, low voltage terminal strip, check valves, single point power. All necessary controls shall be factory installed and wired.
- E. Filters:
 - 1. Housing with access door and filters as scheduled.

2.3 OUTDOOR UNITS

- A. Air-Cooled, Compressor-Condenser Components:
 - 1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Refrigerant Charge: R-410A.
 - c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid sub cooler. Comply with ARI 206/110.
 - d. Shall have two separate and independent refrigeration circuit with integral sub cooling circuit.
 - e. Refrigeration filter drier shall be provided.
 - f. Provide liquid line and suction gas line service valves with gauge ports.
3. Fan: Aluminum-propeller type, directly connected to motor.
4. Motor: Permanently lubricated, with integral thermal-overload protection.
5. Low Ambient Kit: Permits operation down to 45 deg F.
6. Mounting Base: Polyethylene.

2.4 ACCESSORIES

- A. Thermostat: Programmable and coordinate with controls and sequence of operation.
- 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.
- D. Drain Hose: For condensate.

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. Equipment Mounting:
 1. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 23 0548 "Vibration and Seismic Controls for HVAC."
- D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

- C. Duct Connections: Duct installation requirements are specified in Section 23 3113 "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 Section 23 3300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 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.
- D. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 23 8216
REFRIGERANT AIR COILS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes refrigerant air coils.

1.2 ACTION SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- A. ASHRAE Compliance: Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

2.2 REFRIGERANT AIR COILS

- A. Performance Ratings: Tested and rated according to AHRI 410 and ASHRAE 33.
- B. Minimum Working-Pressure Rating: 300 psig.
- C. Source Quality Control: Factory tested to 450 psig.
- D. Tubes: ASTM B 743 copper, minimum 0.020 inch thick.
- E. Fins: Aluminum, minimum 0.006 inch thick.
- F. Suction and Distributor Piping: ASTM B 88, Type L copper tube with brazed joints.
- G. Frames: Galvanized-steel channel frame, minimum 0.052 inch thick for flanged mounting.
- H. Capacities and Characteristics:
 - a. See plans.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install coils level and plumb.
- B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
- C. Install galvanized-steel drain pan under each cooling coil.
 - 1. Construct drain pans with connection for drain; insulated and complying with ASHRAE 62.1.
 - 2. Construct drain pans to extend beyond coil length and width and to connect to condensate trap and drainage.
 - 3. Extend drain pan upstream and downstream from coil face.
 - 4. Extend drain pan under coil headers and exposed supply piping.
- D. Install moisture eliminators for cooling coils. Extend drain pan under moisture eliminator.
- E. Straighten bent fins on air coils.
- F. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.
- G. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- H. Install piping adjacent to coils to allow service and maintenance.
- I. Connect refrigerant piping according to Section 23 2300 "Refrigerant Piping."

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 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.

1.2 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

- A. Product Data: For sleeve seals.

1.4 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 08 Section 08 31 13 - Access Doors and Frames.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section 07 84 13 - Penetration Firestopping.
- E. Coordinate with other trades for connection requirements before rough-in to confirm overcurrent protection and branch circuit conductors.
- F. Design Intent:
 - 1. General: Electrical work description and requirements indicated, establish basic arrangements, dimensions, operating conditions, performance, connections of principal products and devices, and like requirements. Within these limitations, electrical work shall meet construction documents and like requirements indicated, include components not indicated but necessary for operation and performance, and shall be complete, permanent

and of safe operation. Perform whatever modifications or additions to meet requirements and for installation, subject to review by the Engineer.

G. Layout:

1. Dimensions: Dimensions on Drawings shall be verified at the project site. No requirements shall be scaled from the Drawings and used as definite dimensions for layout or fitting work in-place.
2. No Dimensions: Electrical work not located on Drawings by dimensions shall be installed at approximate location indicated on Drawings subject to specified layout, interference and adjustment criteria. Verify locations with other trades and architectural drawings.
3. Inadequacies: When electrical work required by a section of Division 26 - Electrical interferes with other project work, or space conditions or accessibility are inadequate for installation, operation or maintenance, notify the Engineer before starting work.
4. Coordinate Groupings: Electrical work shall have coordinate groupings of devices, controls and like items requiring periodic adjustment, replacement or maintenance at common locations insofar as practicable and at access panels when concealed in construction, except as otherwise required.
5. Review: Proposed modifications or additions to electrical work shall be reviewed by the Engineer before starting work. Assist in working out modifications, additions or inadequacies to provide adjustments.
6. Non-Compliance: In event electrical work does not meet requirements indicated, including demonstrations by inspections, tests or actual operation at project site, remedy electrical work deficiencies and be responsible for resulting loss or damage.
7. Line Right-Of-Ways: Lines whose elevations cannot be changed have right-of-way over lines not required to pitch. Large cross-sectional lines have right-of-way over lines which are not required to pitch.
8. Clearances: Electrical work shall clear building construction, window and door components such as doors, and mechanical/ plumbing equipment. Provide electrical work with maximum headroom, unless otherwise indicated. Where insufficient space is provided, obtain clarification from the Engineer. Code clearance for maintenance for electrical equipment shall be maintained. Coordinate in field with all divisions for necessary modifications to equipment location. Notify engineer, owner, and/or architect of needed changes.

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.

2.2 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 above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch 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 07 Section 07 92 00 - 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 07 Section 07 84 13 - Penetration Firestopping.
- 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 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 annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 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 07 Section 07 84 13 - Penetration Firestopping.

END OF SECTION

SECTION 26 05 19**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES****PART 1 - GENERAL****1.1 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.

1.2 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association 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.

1.5 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS**2.1 CONDUCTORS AND CABLES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.

2. American Insulated Wire Corp.; a Leviton Company.
 3. General Cable Corporation.
 4. Senator Wire & Cable Company.
 5. Southwire Company.
 6. As submitted and approved.
- B. Aluminum and Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN,-THWN, and XHHW-
- D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

- A. 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.
 6. As submitted and approved.
- B. 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. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 07 84 13 - Penetration Firestopping.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders.
- 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 or Type XHHW, single conductors in raceway-
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: 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. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway, Metal-clad cable, Type MC to final device.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- I. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- J. Class 2 Control Circuits: Type THHN-THWN, in raceway. Power-limited cable, concealed in building finishes. Power-limited tray cable, in cable tray.

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 26 Section 26 05 29 - Hangers and Supports for Electrical Systems.
- F. Identify and color-code conductors and cables according to Division 26 Section 26 05 53 - Identification for Electrical Systems.

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.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section 07 84 13 - Penetration Firestopping.
- 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 and no side greater than 16 inches, thickness shall be 0.052-inch.
 - 2. For sleeve rectangle perimeter equal to, or greater than, 50-inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138-inch.
- 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 above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed or per seismic criteria.
- 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 cable, using joint sealant appropriate for size, depth, and location of joint according to Section 07 92 00 - Joint Sealants.
- K. 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 Section 07 84 13 - Penetration Firestopping.
- L. Roof-Penetration Sleeves: Seal penetration of individual cables 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. Size sleeves to allow for 1-inch 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 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 Section 07 84 13 - Penetration Firestopping.

END OF SECTION

SECTION 26 05 26**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:
1. Telecommunications system.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
1. Ground rods.
 2. Ground rings.
 3. Grounding arrangements and connections for separately derived systems.
 4. Grounding for sensitive electronic equipment.
- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
1. Instructions for periodic testing and inspection of grounding features at-ground rings grounding connections for separately derived systems based on NETA MTS NFPA 70B.
 - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
 - b. Include recommended testing intervals.

1.3 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. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 5. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2-inches 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 by 10 feet 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 bare copper conductor, No. 3/0 minimum.
 - 1. Bury at least 24-inches below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. 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, minimum, from wall 6 inches 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 UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.3 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. metal-clad cable runs.
 - 8. 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.
- 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. 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.
- E. 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.
- F. 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 grounding bus.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- G. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. 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.
- D. 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.
- E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- F. Under Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
1. If concrete foundation is less than 20 feet 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.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform 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, 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 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: 3 ohm(s).
 5. Substations and Pad-Mounted Equipment: 5 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

SECTION 26 05 29**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
 - 1. Section 26 05 48 - Vibration And Seismic Controls For Electrical Systems: Products and installation requirements necessary for compliance with seismic criteria.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Nonmetallic slotted channel systems. Include Product Data for components.
 - 4. Equipment supports.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS**2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS**

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. Fabco Plastics Wholesale Limited.
 - d. Seasafe, Inc.
 - 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 - ~~3.~~ Fitting and Accessory Materials: Same as channels and angles.
 - 4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4-inch in diameter.

- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4-inches thick.
 - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 Spring-tension clamps.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section 05 50 00 - Metal Fabrications for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- ~~B.~~ Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 30 00 - Cast-in-Place Concrete.
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33**RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. RGS. Rigid metallic conduit
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. RNC: Rigid nonmetallic conduit.
- G. IAC. Interlock armored cable
- H. MC Cable. Metal Clad Cable
- I. SMR. Surface Metal Raceway

1.3 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.4 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflex Inc.

3. Anamet Electrical, Inc.; Anaconda Metal Hose.
 4. Electri-Flex Co.
 5. Grinnell Co/Tyco International; Allied Tube and Conduit Div.
 6. LTV Steel Tubular Products Company.
 7. Manhattan/CDT/Cole-Flex.
 8. O-Z Gedney; Unit of General Signal.
 9. Wheatland Tube Co.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Aluminium 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: Compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
1. American International.
 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 3. Arnco Corp.
 4. Cantex Inc.
 5. Certainteed Corp.; Pipe & Plastics Group.
 6. Condux International.
 7. ElecSYS, Inc.
 8. Electri-Flex Co.
 9. Lamson & Sessions; Carlon Electrical Products.
 10. Manhattan/CDT/Cole-Flex.
 11. RACO; Division of Hubbell, Inc.
 12. Spiralduct, Inc./AFC Cable Systems, Inc.
 13. Thomas & Betts Corporation.
- B. ENT: NEMA TC 13.
- C. RNC: NEMA TC 2, 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 METAL WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
1. Hoffman.

2. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated or required.
- 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.

2.4 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- C. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.
- D. Nonmetallic Floor Boxes: Nonadjustable, round.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch.
 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures: Plastic finished inside with radio-frequency-resistant paint.
- H. 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.

2.6 FACTORY FINISHES

- A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed: RGS.
 - 2. Concealed: RGS.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 4. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.
- B. Indoors.
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed and Subject to Physical Damage: RGS or IMC Includes raceways in the following locations:
 - a. Mechanical rooms.
 - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - 5. Damp or Wet Locations: IMC or RGS.
 - 6. Boxes and Enclosures: NEMA 250, Type 1.
- C. Minimum Raceway Size: Home runs (over 7 conductors) 1", branch circuits 3/4", runs terminating in a switch or receptacle 1/2".
- 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. EMT Conduit: Use Steel Compression fittings, unless authorized by engineer to use set-screw type.

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 away from parallel runs of flues and steam or hot-water pipes
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Section 26 05 29 - Hangers and Supports for Electrical Systems.
- 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. All metallic conduit connections shall be tight to provide minimum impedance.
- I. Raceways Embedded under Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Change from ENT to, rigid steel conduit or IMC before rising above the floor.
- 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 tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where otherwise required by NFPA 70.
- F. Temperature change.
- a. Outdoor Locations Not Exposed to Direct Sunlight: 125 degrees F
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 degrees F temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F.
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.
- M. Flexible Conduit Connections: Use maximum of 72-inches 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 physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- N. 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.
- O. Set metal floor boxes level and flush with finished floor surface.
- P. 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 31 Section 31 20 00 - Earth Moving for pipe less than 6 inches nominal diameter.
 2. Install backfill as specified in Division 31 Section 31 20 00 - Earth Moving.
 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 of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified Section 31 20 00 - Earth Moving.
 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 of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60-inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12-inches above direct-buried conduits, placing them 24-inches o.c. Align planks along the width and along the centerline of conduit.

3.4 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 Section - Penetration Firestopping.

END OF SECTION

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 1. Conduit, ducts, and duct accessories for direct-buried, concrete-encased duct banks, and in single duct runs.
 2. Handholes and boxes.

1.3 DEFINITION

- A. RNC: Rigid nonmetallic conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 1. Duct-bank materials, including separators and miscellaneous components.
 2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 3. Accessories for manholes, handholes, boxes.
 4. Warning tape.
 5. Warning planks.
- B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
 1. Duct entry provisions, including locations and duct sizes.
 2. Reinforcement details.
 3. Frame and cover design and manhole frame support rings.
 4. Ladder details.
 5. Grounding details.
 6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 7. Joint details.
- C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
 1. Duct entry provisions, including locations and duct sizes.
 2. Cover design.

3. Grounding details.
4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 INFORMATIONAL SUBMITTALS

- A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
 1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
 2. Drawings shall be signed and sealed by a qualified professional engineer.
- B. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.
- C. Qualification Data: For professional engineer and testing agency.
- D. Source quality-control test reports.
- E. Field quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
- B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 1. Notify Construction Manager and/or Owner no fewer than two days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

1.9 COORDINATION

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

1.10 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.
- B. Furnish cable-support stanchions, arms, insulators and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. [Cantex, Inc.](#)
 - 2. [CertainTeed Corp.; Pipe & Plastics Group.](#)
 - 3. [Condux International, Inc.](#)
 - 4. [Electri-Flex Company.](#)
 - 5. [IPEX Inc.](#)
 - 6. [Lamson & Sessions; Carlon Electrical Products.](#)
 - 7. [Spiraduct/AFC Cable Systems, Inc.](#)
- D. Duct Accessories:
 - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.

2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.3 PRECAST CONCRETE HANDHOLES AND BOXES

- 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. Carder Concrete Products.
 2. Christy Concrete Products.
 3. Elmhurst-Chicago Stone Co.
 4. Oldcastle Precast Group.
 5. Riverton Concrete Products; a division of Cretex Companies, Inc.
 6. Utility Concrete Products, LLC.
 7. Utility Vault Co.
 8. Wausau Tile, Inc.
- C. Comply with ASTM C 858 for design and manufacturing processes.
- D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
 1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
 - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
 - b. Cover Handle: Recessed.
 4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
 - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
 - b. Cover Handle: Recessed.
 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 6. Cover Legend: Molded lettering, As indicated for each service.
 7. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
 8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
 - a. Extension shall provide increased depth of 12 inches.
 - b. Slab: Same dimensions as bottom of enclosure and arranged to provide closure.

9. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.
 - a. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
 - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
 - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
10. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - a. Type and size shall match fittings to duct or conduit to be terminated.
 - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
11. Handholes **12 inches wide by 24 inches long** and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.4 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Description: Comply with SCTE 77.
 1. Color: Gray.
 2. Configuration: Units shall be designed for flush burial and have open 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. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
 7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 8. Handholes **12 inches wide by 24 inches long** and larger shall have factory-installed inserts for cable racks and pulling-in irons.
- B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
 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:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
 - a. Armorcast Products Company.

- b. [Carson Industries LLC.](#)
 - c. [CDR Systems Corporation.](#)
 - d. [NewBasis.](#)

- C. 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:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. [Basis-of-Design Product](#): Subject to compliance with requirements, provide a comparable product by one of the following:
 - a. [Armorcast Products Company.](#)
 - b. [Carson Industries LLC.](#)
 - c. [Christy Concrete Products.](#)
 - d. [Synertech Moulded Products, Inc.; a division of Oldcastle Precast.](#)

- D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of fiberglass.
 - 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:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. [Basis-of-Design Product](#): Subject to compliance with requirements, provide a comparable product by one of the following:
 - a. [Carson Industries LLC.](#)
 - b. [Christy Concrete Products.](#)
 - c. [Nordic Fiberglass, Inc.](#)

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.

- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes 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 the 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 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.
- B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.
- C. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type PC-80-PVC, in direct-buried duct bank, unless otherwise indicated.
- D. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-80-PVC, in direct-buried duct bank, unless otherwise indicated.
- E. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.
- F. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.
- G. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EB-20-PVC, in concrete-encased duct bank, unless otherwise indicated.
- H. Underground Ducts Crossing Driveways Roadways and Railroads: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.2 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:
 - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
 - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier structural load rating.
 - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Heavy-duty fiberglass units with polymer concrete frame and cover, SCTE 77, Tier 8 structural load rating.
 - 4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Section 017329 "Cutting and Patching."

3.4 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of **48 inches (1220 mm)**, both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately **10 inches (250 mm)** o.c. for **5-inch (125-mm)** ducts, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing **10 feet (3 m)** from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
 - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least **10 feet (3 m)** outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least **15-psig (1.03-MPa)** hydrostatic pressure.
- G. Pulling Cord: Install **100-lbf- (445-N-)** test nylon cord in ducts, including spares.
- H. Concrete-Encased Ducts: Support ducts on duct separators.
 - 1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per **20 feet (6 m)** of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately **6 inches (150 mm)** between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - 2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

- a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install **3/4-inch (19-mm)** reinforcing rod dowels extending **18 inches (450 mm)** into concrete on both sides of joint near corners of envelope.
3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
 4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 6. Minimum Space between Ducts: **3 inches (75 mm)** between ducts and exterior envelope wall, **2 inches (50 mm)** between ducts for like services, and **4 inches (100 mm)** between power and signal ducts.
 7. Depth: Install top of duct bank at least **24 inches (600 mm)** below finished grade in areas not subject to deliberate traffic, and at least **30 inches (750 mm)** below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
 8. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
 9. Stub-Ups: Use 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. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of **60 inches (1500 mm)** from edge of base. Install insulated grounding bushings on terminations at equipment.
 10. Warning Tape: Bury warning tape approximately **12 inches (300 mm)** above all concrete-encased ducts and duct banks. Align tape parallel to and within **3 inches (75 mm)** of the centerline of duct bank. Provide an additional warning tape for each **12-inch (300-mm)** increment of duct-bank width over a nominal **18 inches (450 mm)**. Space additional tapes **12 inches (300 mm)** apart, horizontally.
- I. Direct-Buried Duct Banks:
 1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
 2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per **20 feet (6 m)** of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately **6 inches (150 mm)** between tiers.
 3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than **6 inches (150 mm)** in nominal diameter.
 4. Install backfill as specified in Section 312000 "Earth Moving."

5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
6. Install ducts with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. 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.
10. 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 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.
11. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried ducts and duct banks, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional planks 12 inches (300 mm) apart, horizontally.

3.5 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.7-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 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 ducts and 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.
- G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 - 1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Section 033000 "Cast-in-Place Concrete," with a troweled finish.
 - 2. Dimensions: 4 inches wide by 12 inches deep (250 mm wide by 300 mm deep).

3.6 GROUNDING

- A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
 - 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 - 3. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.8 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

SECTION 26 05 48**VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes the following:
 - 1. Isolation pads.
 - 2. Spring isolators.
 - 3. Restrained spring isolators.
 - 4. Channel support systems.
 - 5. Restraint cables.
 - 6. Hanger rod stiffeners.
 - 7. Anchorage bushings and washers.
- B. Related Sections include the following:
 - 1. Section 26 05 29 - Hangers and Supports for Electrical Systems: Commonly used electrical supports and installation requirements.

1.2 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. As indicated on Structural Drawing S1.1.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 - 3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.
- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
 - a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 26 Sections for equipment mounted outdoors.
 - 2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.

3. Field-fabricated supports.
4. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
- D. Welding certificates.
- E. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ace Mountings Co., Inc.
 2. Amber/Booth Company, Inc.
 3. California Dynamics Corporation.
 4. Isolation Technology, Inc.
 5. Kinetics Noise Control.
 6. Mason Industries.
 7. Vibration Eliminator Co., Inc.
 8. Vibration Isolation.
 9. Vibration Mountings & Controls, Inc.
- B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

- 4- Resilient Material: Oil- and water-resistant neoprene or rubber-
- C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
 - 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
 - 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. California Dynamics Corporation.
 - 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 4. Hilti Inc.
 - 5. Loos & Co.; Seismic Earthquake Division.
 - 6. Mason Industries.
 - 7. TOLCO Incorporated; a brand of NIBCO INC.
 - 8. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

- E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
 9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Identification for raceway and metal-clad cable.
 - 2. Identification for conductors and communication and control cable.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY 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. Color for Printed Legend:
 - 1. Power Circuits: Black letters on an orange field.
 - 2. Legend: Indicate system or service and voltage, if applicable.
- C. 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.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch-thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05-inch, with stamped legend, punched for use with self-locking nylon tie fastener.
- E. Write-On Tags: Polyester tag, 0.010-inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend shall indicate type of underground line.

2.4 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: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10-inches.
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16-inch thick for signs up to 20 sq. in. and 1/8-inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face-
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch.
- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch. Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.
- C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8-inch.
- D. 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.
- E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1-inch.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16-inch.
 - 2. Tensile Strength: 50 lb, minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black, except where used for color-coding.

- B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Exterior concrete and masonry primer.
 - 2) Finish Coats: Exterior semigloss acrylic enamel.
 2. Exterior Concrete Unit Masonry:
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a block filler.
 - 1) Block Filler: Concrete unit masonry block filler.
 - 2) Finish Coats: Exterior semigloss acrylic enamel.
 3. Exterior Ferrous Metal:
 - a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Exterior ferrous-metal primer.
 - 2) Finish Coats: Exterior semigloss alkyd enamel.
 4. Exterior Zinc-Coated Metal (except Raceways):
 - a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Exterior zinc-coated metal primer.
 - 2) Finish Coats: Exterior semigloss alkyd enamel.
 5. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):
 - a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Interior concrete and masonry primer.
 - 2) Finish Coats: Interior semigloss alkyd enamel.
 6. Interior Concrete Unit Masonry:
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a block filler.
 - 1) Block Filler: Concrete unit masonry block filler.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
 7. Interior Gypsum Board:
 - a. Semigloss Acrylic-Enamel Finish: One-finish coat(s) over a primer.
 - 1) Primer: Interior gypsum board primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
 8. Interior Ferrous Metal:
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Interior ferrous-metal primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
 9. Interior Zinc-Coated Metal (except Raceways):
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Interior zinc-coated metal primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
- C. 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 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label, snap-around label, or self-adhesive vinyl tape applied in bands.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands or snap-around, color-coding bands:
1. Fire Alarm System: Red.
 2. Fire-Suppression Supervisory and Control System: Red and yellow.
 3. Combined Fire Alarm and Security System: Red and blue.

4. Security System: Blue and yellow.
 5. Mechanical and Electrical Supervisory System: Green and blue.
 6. Telecommunication System: Green and yellow.
 7. Control Wiring: Green and red.
- C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape, marker tape, aluminum wraparound marker labels, metal tags, or write-on tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape, marker tape, aluminum wraparound marker labels, metal tags, or write-on tags]. Identify each ungrounded conductor according to source and circuit number.
- E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Limit use of underground-line warning tape to direct-buried cables-
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels, baked-enamel warning signs, metal-backed, and butyrate warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
1. 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.
 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- H. Instruction Signs:
1. Operating Instructions: 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.
 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer-
- I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:

- a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label
Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch-high label; where 2 lines of text are required, use labels 2-inches high.
 - ~~b.~~ Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
2. Equipment to Be Labeled:
- a. Panelboards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.
 - c. Electrical switchgear and switchboards.
 - d. Transformers.
 - e. Emergency system boxes and enclosures.
 - f. Disconnect switches.
 - g. Enclosed circuit breakers.
 - h. Motor starters.
 - i. Push-button stations.
 - j. Power transfer equipment.
 - k. Contactors.
 - l. Remote-controlled switches, dimmer modules, and control devices.
 - m. Power-generating units.
 - n. Voice and data cable terminal equipment.
 - o. Master clock and program equipment.
 - p. Intercommunication and call system master and staff stations.
 - q. Television/audio components, racks, and controls.
 - r. Fire-alarm control panel and annunciators.
 - s. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
 - t. Monitoring and control equipment.
 - u. Uninterruptible power supply equipment.
 - v. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

3.2 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 nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded-service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied-
 - 2. Colors for 208/120-V Circuits:

- a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
3. Colors for 480/277-V Circuits:
- a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6-inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8-inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16-inches overall.
- J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Time switches.
 - 2. Outdoor and indoor photoelectric switches.
 - 3. Indoor occupancy sensors.
 - 4. Lighting contactors.
 - 5. Emergency shunt relays.
- B. Related Sections include the following:
 - 1. Sections 26 09 33 - Central Dimming Controls and 26 09 36 - Modular Dimming Controls: Architectural dimming system equipment.
 - 2. Section 26 27 26 - Wiring Devices: Wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.4 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.

1.5 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Area Lighting Research, Inc.; Tyco Electronics.
 2. Grasslin Controls Corporation; a GE Industrial Systems Company.
 3. Intermatic, Inc.
 4. Leviton Mfg. Company Inc.
 5. Lightolier Controls; a Genlyte Company.
 6. Lithonia Lighting; Acuity Lighting Group, Inc.
 7. Paragon Electric Co.; Invensys Climate Controls.
 8. Square D; Schneider Electric.
 9. TORK.
 10. Touch-Plate, Inc.
 11. Watt Stopper (The).
- B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
1. Contact Configuration: SPST, DPST, and DPDT.
 2. Contact Rating: 30-A inductive or resistive, 240-V ac, 20-A ballast load, 120/240-V ac.
 3. Programs: 8 channels; each channel shall be individually programmable with 40 on-off operations per week and an annual holiday schedule that overrides the weekly operation on holidays.
 4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
 5. Astronomic Time: All channels.
 6. Battery Backup: For schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Area Lighting Research, Inc.; Tyco Electronics.
 2. Cooper Lighting
 3. Intermatic, Inc.
 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 5. Novitas, Inc.
 6. Paragon Electric Co.; Invensys Climate Controls.
 7. Square D; Schneider Electric.
 8. TORK.
 9. Touch-Plate, Inc.
 10. Watt Stopper (The).
- B. Description: Solid state, with DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 2. Time Delay: 15-second minimum, to prevent false operation.
 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

- C. Description: Solid state, with DPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.
1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
 2. Time Delay: 30-second minimum, to prevent false operation.
 3. Lightning Arrester: Air-gap type.
 4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.3 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Lighting.
 2. Leviton Mfg. Company Inc.
 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 4. Novitas, Inc.
 5. Sensor Switch, Inc.
 6. Watt Stopper (The).
 7. Lutron, Inc.
 8. Alternate as submitted and approved.
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.
 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.
- C. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

2.4 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Products.
 2. Hubbell Lighting.
 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 4. Square D; Schneider Electric.
 5. Watt Stopper (The).
- B. Description: Electrically operated and electrically held, combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.
 4. Provide with control and pilot devices as scheduled, matching the NEMA type specified for the enclosure.

2.5 EMERGENCY SHUNT RELAY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lighting Control and Design, Inc.
 2. Lutron, Inc.
 3. As submitted and approved.
- B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or **automatic** switching contacts; complying with UL 924.
1. Coil Rating: 120V.

2.6 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section 26 05 19 Low-Voltage Electrical Power Conductors and Cables.
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables. Minimum conduit size shall be 1/2-inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 26 05 53 Identification for Electrical Systems.
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Section 26 09 43 Network Lighting Controls.
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section 01 79 00 - Demonstration and Training.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
 - 3. Transient voltage suppression panelboards.

1.2 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, 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. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems Include the following:
 - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. 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."
 - b. 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 and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Qualification Data: For testing agency.
- E. Field quality-control test reports including the following:
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.
- F. Panelboard Schedules: For installation in panelboards.
- G. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "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.

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 or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.
- C. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Section 01 60 00 Product Requirements.
- E. 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.
- F. Comply with NEMA PB 1.
- G. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
1. Ambient Temperature: Not exceeding 104 deg F.
 2. Altitude: Not exceeding 6600 feet.

- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet.

1.6 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, and encumbrances to workspace clearance requirements.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corporation; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Protection Div.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D.
 - 2. Transient Voltage Suppression Panelboards:
 - a. Current Technology.
 - b. Liebert Corporation.
 - c. Square D

2.2 MANUFACTURED UNITS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- B. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
 - 1. Rated for environmental conditions at installed location.
 - a. Outdoor Locations: NEMA 250, Type 3R.
 - b. Kitchen Areas: NEMA 250, Type 4X; stainless steel.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 - 5. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- C. Phase and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
 - 3. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment 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.
- D. Conductor Connectors: Suitable for use with conductor material.
 1. Main and Neutral Lugs: Mechanical type.
 2. Ground Lugs and Bus Configured Terminators: Compression type.
 3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 4. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 DISTRIBUTION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.
- B. Main Overcurrent Protective Devices: Circuit breaker.
- C. Branch Overcurrent Protective Devices:
 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
 2. 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.
 3. Fused switches.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 TRANSIENT VOLTAGE SUPPRESSION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Devices: Thermal-magnetic circuit breaker.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.
- D. Bus: Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
- E. Transient Voltage Suppression Device: IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.
 1. Minimum Single-Impulse Current Ratings:
 - a. Line to Neutral: 100,000 A.
 - b. Line to Ground: 100,000 A.
 - c. Neutral to Ground: 50,000 A.
 2. Protection modes shall be as follows:
 - a. Line to neutral.

- b. Line to ground.
- c. Neutral to ground.
3. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
4. Maximum Category C Combination Wave Clamping Voltage: 600 V, line to neutral and line to ground on 120/208 V systems.
5. Maximum UL 1449 Clamping Levels: 400 V, line to neutral and line to ground on 120/208 V systems.
6. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
7. Accessories:
 - a. Form-C contacts, one normally open and one normally closed, for remote monitoring of system operation. Contacts to reverse position on failure of any surge diversion module.
 - b. Audible alarm activated on failure of any surge diversion module.
 - c. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.

2.7 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 6. GFCI Circuit Breakers: Single- and two-pole configurations with **[5] [30]**-mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 4. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
 5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at ~~55~~ percent of rated voltage.
 6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage-with field-adjustable 0.1- to 0.6-second time delay.
 7. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 9. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 10. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- D. Fuses are specified in Division 26 Section 26 28 13 - Fuses.

2.8 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Furnish portable test set to test functions of solid-state trip devices without removal from panelboard.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section 26 05 48 Vibration and Seismic Controls for Electrical Systems.
- C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install overcurrent protective devices and controllers.
 1. Set field-adjustable switches and circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section 26 05 53 - Identification for Electrical Systems.
- B. Create a directory to indicate installed circuit loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Connect wiring according to Division 26 Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- C. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. 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.

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Receptacles, receptacles with integral GFCI, and associated device plates.
 2. Twist-locking receptacles.
 3. Receptacles with integral surge suppression units.
 4. Hospital grade receptacles.
 5. Wall-box motion sensors.
 6. Isolated-ground receptacles.
 7. Snap switches and wall-box dimmers.
 8. Solid-state fan speed controls.
 9. Wall-switch and exterior occupancy sensors.
 10. Communications outlets.
 11. Pendant cord-connector devices.
 12. Cord and plug sets.
 13. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.2 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.

1.3 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.

1.4 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.

1.5 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. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Cooper; 8310 (single), 8300 (duplex).
 - b. Hubbell; HBL8310 (single), HBL8300 (duplex).
 - c. Leviton; 8310 (single), 8300 (duplex).
 - d. Pass & Seymour; 8301 (single), 8300H (duplex).
 - 2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
- C. 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.
- D. Tamper-Resistant 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; TR8300.

- b. Hubbell; HBL8300SG.
- c. Leviton; 8300-SGG.
- d. Pass & Seymour; 63H.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.

2.4 TVSS RECEPTACLES

- A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
 - 1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
 - 2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
- B. Duplex TVSS Convenience Receptacles:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5362BLS.
 - b. Hubbell; HBL5362SA.
 - c. Leviton; 5380.
 - 2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
- C. Isolated-Ground, Duplex Convenience Receptacles:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; IG5362BLS.
 - b. Hubbell; IG5362SA.
 - c. Leviton; 5380-IG.
 - 2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. 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 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.

2.6 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 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. 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.
 2. 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.

2.8 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.

2.9 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 6111 for 120 V, 6117 for 277 V.
 - b. Hubbell; WS1277.
 - c. Leviton; ODS 10-ID.
 - d. Pass & Seymour; WS3000.
 - e. Watt Stopper (The); WS-200.
2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..

- B. Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; AT120 for 120 V, AT277 for 277 V.
 - b. Leviton; ODS 15-ID.
 2. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft..
- C. Long-Range Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATP1600WRP.
 - b. Leviton; ODWWV-IRW.
 - c. Pass & Seymour; WA1001.
 - d. Watt Stopper (The); CX-100.
 2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft..
- D. Long-Range Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATD1600WRP.
 - b. Leviton; ODW12-MRW.
 - c. Watt Stopper (The); DT-200.
 2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft..
- E. Wide-Range Wall-Switch Sensors:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATP120HBRP.
 - b. Leviton; ODWHB-IRW.
 - c. Pass & Seymour; HS1001.
 - d. Watt Stopper (The); CX-100-3.
 2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft..

2.10 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 3562.
 - b. Leviton; 40595.
 2. 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.

2.11 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: Cast aluminum 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, die-cast aluminum with lockable cover.

2.12 FLOOR SERVICE FITTINGS

- A. Type: Modular, flap-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Round, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

2.13 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Hubbell Incorporated; Wiring Device-Kellems.
 2. Pass & Seymour/Legrand; Wiring Devices & Accessories.
 3. Square D/ Schneider Electric.
 4. Thomas & Betts Corporation.
 5. Wiremold Company (The).
- B. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
 1. Service Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks.
 2. Size: Selected to fit nominal 3-inch cored holes in floor and matched to floor thickness.
 3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
 4. Closure Plug: Arranged to close unused 3-inch cored openings and reestablish fire rating of floor.
 5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, 4-pair, Category 5e voice and data communication cables.

2.14 MULTIOUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Hubbell Incorporated; Wiring Device-Kellems.
 2. Wiremold Company (The).
- B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: PVC
- D. Wire: No. 12 AWG.

2.15 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 1. Wiring Devices Connected to Normal Power System:
 - a. All general purpose areas unless otherwise noted – light almond
 - b. Kitchen areas brushed stainless steel plates with grey devices.
 2. Wiring Devices Connected to Emergency Power System: Red.

3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: Orange-

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. Pigtailling 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 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 down, 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 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. 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

SECTION 26 28 13**FUSES****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes the following:
1. Cartridge fuses rated 600 V and less for use in switches, panelboards, switchboards, controllers, and motor-control centers.
 2. Spare-fuse cabinets.

1.2 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 2. Let-through current curves for fuses with current-limiting characteristics.
 3. Time-current curves, coordination charts and tables, and related data.
 4. Fuse size for elevator feeders and elevator disconnect switches.
- B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Division 01 Section 01 78 23 - Operation and Maintenance Data, include the following:
 - a. Let-through current curves for fuses with current-limiting characteristics.
 - b. Time-current curves, coordination charts and tables, and related data.
 - c. Ambient temperature adjustment information.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- 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 NEMA FU 1.
- D. Comply with NFPA 70.

1.4 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.5 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.6 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. Fuses: Quantity equal to 10 percent of each fuse type and size, but no fewer than 2 of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussman, Inc.
 - 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

2.3 SPARE-FUSE CABINET

- A. Cabinet: Wall-mounted, 0.05-inch-thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
 - 4. Fuse Pullers: For each size of fuse.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Feeders: Class RK1, time delay.
- B. Motor Branch Circuits: Class RK1, time delay.
- C. Other Branch Circuits: Class RK1, time delay.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 26 28 16**ENCLOSED SWITCHES AND CIRCUIT BREAKERS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Bolted-pressure contact switches.
 - 4. High-pressure, butt-type contact switches.
 - 5. Molded-case circuit breakers.
 - 6. Molded-case switches.
 - 7. Enclosures.

1.2 DEFINITIONS

- A. GD: General duty.
- B. GFCI: Ground-fault circuit interrupter.
- C. HD: Heavy duty.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

1.3 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, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current rating.
 - 4. UL listing for series rating of installed devices.
 - 5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in Division 26 Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems Include the following:
 - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. 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."
 - b. 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 and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Qualification Data: For testing agency.
- E. Field quality-control test reports including the following:
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.
- F. Manufacturer's field service report.
- G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section 01 78 23 - Operation and Maintenance Data, include the following:
1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 2. Time-current curves, including selectable ranges for each type of circuit breaker.

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 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.
- D. 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.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 2. Altitude: Not exceeding 6600 feet.

1.6 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

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 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers:
1. Eaton Corporation; Cutler-Hammer Products.
 2. General Electric Co.; Electrical Distribution & Control Division.
 3. Siemens Energy & Automation, Inc.
 4. Square D/Group Schneider.
- B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type **[GD]** **[HD]**, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Nonfusible Switch, 600 A and Smaller: NEMA KS 1, Type **[GD]** **[HD]**, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. 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; and labeled for copper and aluminum neutral conductors.
 3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 FUSED POWER CIRCUIT DEVICES

- A. Bolted-Pressure Contact Switch: UL 977; operating mechanism shall use a rotary-mechanical-bolting action to produce and maintain high-clamping pressure on the switch blade after it engages the stationary contacts.
1. Manufacturers:
 - a. Boltswitch, Inc.
 - b. Eaton Corporation; Cutler-Hammer Products.
 - c. Pringle Electrical Mfg. Co.
 - d. Siemens Energy & Automation, Inc.
 - e. Square D/Group Schneider.
- B. High-Pressure, Butt-Type Contact Switch: UL 977; operating mechanism shall use butt-type contacts and a spring-charged mechanism to produce and maintain high-contact pressure when switch is closed.
1. Manufacturers:
 - a. General Electric Co.; Electrical Distribution & Control Division.
 2. Main Contact Interrupting Capability: Twelve times the switch current rating, minimum.
 3. Operating Mechanism: Manual handle operation to close switch stores energy in mechanism for closing and opening.
 - a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
 - b. Mechanical Trip: Operation of mechanical lever or push button or another device causes switch to open.
 4. Auxiliary Switches: Factory installed, SPDT, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.

5. Service-Rated Switches: Labeled for use as service equipment.
6. Ground-Fault Relay: Comply with UL 1053. Self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.
 - a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground fault indicator.
 - b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
 - c. No-Trip Relay Test: Operation of "no-trip" test control permits ground-fault simulation test without tripping switch.
 - d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).
7. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.

2.4 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Manufacturers:
 1. Eaton Corporation; Cutler-Hammer Products.
 2. General Electric Co.; Electrical Distribution & Control Division.
 3. Moeller Electric Corporation.
 4. Siemens Energy & Automation, Inc.
 5. Square D/Group Schneider.
- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
 5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
 6. GFCI Circuit Breakers: Single- and two-pole configurations with [5] [30]-mA trip sensitivity.
- C. Molded-Case Circuit-Breaker Features and Accessories:
 1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 5. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section 26 09 13 - Electrical Power Monitoring and Control.
 6. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [55] [75] percent of rated voltage.

7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
 8. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 10. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
- D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- E. Molded-Case Switch Accessories:
1. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and material of conductors.
 2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
 3. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage. Provide "dummy" trip unit where required for proper operation.
 4. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage-with field-adjustable 0.1- to 0.6-second time delay. Provide "dummy" trip unit where required for proper operation.
 5. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 6. Key Interlock Kit: Externally mounted to prohibit operation; key shall be removable only when switch is in off position.

2.5 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
1. Outdoor Locations: NEMA 250, Type 3R.
 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section 26 05 29 - Hangers and Supports for Electrical Systems, and concrete materials and installation requirements are specified in Division 03.

3.3 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section 26 05 48 Vibration and Seismic Controls for Electrical Systems.
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section 26 05 53 - Identification for Electrical Systems.
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section 26 05 53 - Identification for Electrical Systems.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Test mounting and anchorage devices according to requirements in Section 26 05 48 Vibration and Seismic Controls for Electrical Systems.
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.6 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION

SECTION 26 43 13**TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE
ELECTRICAL POWER CIRCUITS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes TVSSs for low-voltage power, control, and communication equipment.
- B. Related Sections include the following:
 - 1. Section 26 27 26 – Wiring Devices: Devices with integral TVSSs.
 - 2. Section 26 24 13 – Switchboards: Factory-installed TVSSs.
 - 3. Section 26 24 16 – Panelboards: Factory-installed TVSSs.

1.2 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. SVR: Suppressed voltage rating.
- C. TVSS: Transient voltage surge suppressor.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- B. Product Certificates: For transient voltage suppression devices, signed by product manufacturer certifying compliance with the following standards:
 - 1. UL 1283.
 - 2. UL 1449.
- C. Qualification Data: For testing agency.
- D. Field quality-control test reports, including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Failed test results and corrective action taken to achieve requirements.
- E. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.
- F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing 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. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- D. 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.
- E. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- F. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."
- G. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449, "Transient Voltage Surge Suppressors."

1.5 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's written permission.
- B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 2. Operating Temperature: 30 to 120 deg F.
 3. Humidity: 0 to 85 percent, noncondensing.
 4. Altitude: Less than 20,000 feet above sea level.

1.6 COORDINATION

- A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.
- B. Coordinate surge protection devices with Section "Electrical Power Monitoring and Control."

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Substantial Completion.
- B. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

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. Replaceable Protection Modules: One of each size and type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Current Technology, Inc.
 2. Cutler-Hammer, Inc.; Eaton Corporation.
 3. Liebert Corporation; a division of Emerson.
 4. Square D; Schneider Electric.

2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
- B. Surge Protection Device Description: Modular design with field-replaceable modules, sine-wave-tracking type with the following features and accessories:
1. Fuses, rated at 200-kA interrupting capacity.
 2. Fabrication using bolted compression lugs for internal wiring.
 3. Integral disconnect switch.
 4. Redundant suppression circuits.
 5. Redundant replaceable modules.
 6. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
 7. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 8. LED indicator lights for power and protection status.
 9. Audible alarm, with silencing switch, to indicate when protection has failed.
 10. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
 11. Surge-event operations counter.
- C. Peak Single-Impulse Surge Current Rating: 320 kA per phase.
- D. Connection Means: Permanently wired.
- E. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 480Y/277 and 208Y/120, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 800 V for 480Y/277, 400 V for 208Y/120.
 2. Line to Ground: 800 V for 480Y/277, 400 V for 208Y/120.
 3. Neutral to Ground: 800 V for 480Y/277, 400 V for 208Y/120.
- F. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.

2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

2.3 PANELBOARD SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
- B. Surge Protection Device Description: Modular design with field-replaceable modules, sign-wave-tracking type with the following features and accessories:
1. Fuses, rated at 200-kA interrupting capacity.
 2. Fabrication using bolted compression lugs for internal wiring.
 3. Integral disconnect switch.
 4. Redundant suppression circuits.
 5. Redundant replaceable modules.
 6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 7. LED indicator lights for power and protection status.
 8. Audible alarm, with silencing switch, to indicate when protection has failed.
 9. One set of dry contacts rated at 5 A and 250-V, ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
 10. Surge-event operations counter.
- C. Peak Single-Impulse Surge Current Rating: 120 kA per phase.

2.4 PRESSORS FOR ELECTRONIC-GRADE PANELBOARDS

- A. Surge Protection Device Description: Sine-wave-tracking type, panel-mounted design with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
 4. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
- B. Peak Single-Impulse Surge Current Rating: 80 kA per phase.
- C. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 400 V for 208Y/120.
 2. Line to Ground: 400 V for 208Y/120.
 3. Neutral to Ground: 400 V for 208Y/120.

2.5 PLUG-IN SURGE SUPPRESSORS

- A. Description: Non-modular, plug-in suppressors with at least four 15-A, 120-V ac, NEMA WD 6, Configuration 15-15R receptacles, suitable to plug into a NEMA WD 6, Configuration 15-15R receptacle; with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. LED indicator lights for reverse polarity and open outlet ground.
 3. Circuit breaker and thermal fusing. When protection is lost, circuit opens and cannot be reset.

- B. Peak Single-Impulse Surge Current Rating: 13 kA per phase.
- C. Protection modes and UL 1449 SVR shall be as follows:
 - 1. Line to Neutral: 475 V.
 - 2. Line to Ground: 475 V.
 - 3. Neutral to Ground: 475 V.

2.6 ENCLOSURES

- A. NEMA 250, with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
 - 1. Provide multipole, circuit breaker as prescribed by manufacturer as a dedicated disconnect for suppressor, unless otherwise indicated.

3.2 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect service entrance equipment, panelboards, control terminals, and/or data terminals to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect equipment installation, including connections. Report results in writing.
 - 1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices. Refer to Section 01 79 00 Demonstration and Training.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- B. Section Includes:
1. Interior lighting fixtures, lamps, and ballasts.
 2. LED lighting.
 3. Exit signs.
 4. Lighting fixture supports.
- C. Related Sections:
5. Section 01 78 43 - Spare Parts: Spare lamps for exterior and interior lighting fixture lamps.
 6. Section 26 09 23 - Lighting Control Devices: Automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 7. Section 26 09 33 - Central Dimming Controls.
 8. 26 09 36 - Modular Dimming Controls: Architectural dimming systems.
 9. Section 26 27 26 - Wiring Devices: Manual wall-box dimmers for incandescent lamps.

1.2 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.
- H. Night Lights: Light fixtures that are wired to the unswitched leg of the circuit. Night lights are not to be confused with emergency lights, which have a second source of power and may be switched.

1.3 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. Driver.
 4. Energy-efficiency data.
 5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article in Division 23 Section 23 37 13 - 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 23 Section 23 37 13 - 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. Occupancy sensors.
 - f. 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.
- J. Product Data: Arrange in order of luminaire designation. The submittals shall include data on features, ratings, listings, certifications, accessories, finishes, dimensions, emergency components, photometric data, and luminaire efficiency data.
- K. Installation, Operation, and Maintenance Manuals.

1.4 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. LED fixtures shall comply with the following:
 - 1. UL Standard 8750 "Light Emitting Diode Equipment for Use in Lighting Products", IES Standard LM-79 "Electrical and Photometric Measurements of Solid-State Lighting Products", IES Standard LM-80 "Measuring Lumen Maintenance of LED Light Sources", and IES Standard TM-21-11 "Projecting Long Term Lumen Maintenance of LED Light Sources".
 - 2. ANSI C78.377 "Specifications for the Chromaticity of Solid State Lighting Products" with LEDs binned within a maximum three-step MacAdam Ellipse to ensure color consistency amongst luminaries of the same type.

1.5 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.

1.6 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 and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.
- B. For non-LED lighting fixtures and components, provide a complete warranty for parts and labor for a minimum of one year from the date of Substantial Completion.
- C. For LED fixtures, lamps, drivers, and components, provide a complete warranty for parts and labor for a minimum of five years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

- B. In Interior Lighting Fixture Schedule where titles below are column or row headings that 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. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

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. Metal Parts: Free of burrs and sharp corners and edges.
- E. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- F. 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.
- G. 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 minimum unless different thickness is indicated.
 - b. UV stabilized.
 2. Glass: Annealed crystal glass, unless otherwise indicated.
- H. Provide lighting fixtures in accordance with the Fixture Schedule.
1. Provide only LED fixtures with a Design Lights Consortium (DLC) listing, a U.S. Department of Energy (DOE) "LED Lighting Facts" label, or a U.S. Environmental Protection Agency (EPA) ENERGY STAR label, which have demonstrated third-party testing verification.
- I. Recessed lighting fixtures shall be thermally protected.
- J. LED fixtures shall be modular and allow for separate replacement of LED lamps and drivers. User serviceable LED lamps and drivers shall be replaceable from the room side.
- K. Dimmable LED fixtures shall have either a 0-10 volt, 3-wire dimming driver, or a two-step (50 to-100 percent) line voltage, two switch controlled dimming driver, as shown on the drawings.

2.2 LAMPS

- A. LED lamps shall have a color temperature of 3500 degrees K, a CRI of 80 minimum, and a lumen maintenance L70 rating of 50,000 hours minimum.
- B. Retrofit LED lamps shall comply with NEMA SSL 4 "SSL Retrofit Lamps: Suggested Minimum Performance Requirements".
- C. Incandescent lamps shall be rated 120 volts and shall have a life of 2,000 hours minimum. Standard "A" Type lamps shall be inside frosted.

H. Spare lamp: Refer to Section 01 78 43 - Spare Parts.

2.3 DRIVERS

- A. LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 "Electronic Drivers for LED Devices, Arrays, or Systems". LED drivers shall have a sound rating of "A", have a minimum efficiency of 85 percent, and be rated for a THD of less than 20 percent at all input voltages.
- B. Dimmable LED drivers shall be 1% 0-10V type. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across their full dimming range.
- C. Drivers shall be rated for the ambient temperatures in which they are located. Outdoor fixtures shall be equipped with ballasts or drivers rated for reliable starting to -20 degrees F. Indoor fixtures located in areas with direct sunlight or above normal ambient temperatures shall have ballasts or drivers rated at 55 degrees C minimum.
- H. Individually fused drivers shall have their fuses accessible from outside of the fixture chassis.

2.4 EMERGENCY LIGHTING

- A. Emergency lighting shall consist of normal lighting fixtures with battery-inverter system backup, emergency lighting fixtures with individual battery backup, or sealed beam emergency lighting units in accordance with the Fixture Schedule.
 - 1. Battery-backed emergency lighting fixtures shall consist of an LED fixture connected either to a battery pack and charger mounted remote from the fixture, or to emergency power ballast mounted internal to the fixture. Minimum light output shall be 100% lumens. The battery shall be nickel cadmium and sized for a minimum of 90 minutes of fixture operation. The charger shall be solid-state and provide overload, short circuit, brownout and low battery voltage protection. The battery and charger shall include self-diagnostic and self-exercising circuitry to exercise and test itself for 5 minutes every month and for 30 minutes every 6 months. The fixture shall include a test/monitor module with LED status indicating lights mounted so as to be visible to the public. The fixture shall not contain an audible alarm.
 - a. Remote mounted battery packs and chargers: Chloride, Dual-Lite, Emergi-Lite, Exide Lightguard, Lightalarms, Lithonia or Sure-Lites. b. Emergency power ballasts: Bodine or Lithonia
 - 2. Battery-backed LED emergency lighting fixtures shall consist of a normal LED fixture with some or all of the LEDs connected to a battery and charger. The battery shall be nickel cadmium and sized for a minimum of 90 minutes of fixture operation. The charger shall be solid-state and provide overload, short circuit, brownout and low battery voltage protection. The battery and charger shall include self-diagnostic and self-exercising circuitry to exercise and test itself for 5 minutes every month and for 30 minutes every 6 months. The fixture shall include a test/monitor module with LED status indicating lights mounted so as to be visible to the public. The fixture shall not contain an audible alarm.
 - 3. Sealed beam emergency lighting units shall consist of sealed beam LED lamps connected to an internally mounted battery and charger. The battery shall be nickel cadmium and sized for a minimum of 90 minutes of battery operation. The charger shall be solid-state and provide overload, short circuit, brownout and low battery voltage protection. The unit shall be suitable for wall or ceiling mounting as required. It shall include self-diagnostic and self-exercising circuitry to exercise and test itself for 5 minutes every month and for 30 minutes every 6 months. The unit shall include a test/monitor module with LED status indicating lights mounted so as to be visible to the public. The unit shall not contain an audible alarm.

2.5 EXIT SIGNS

- A. Exit signs shall be of the LED type. Fluorescent, electro luminescent light panel, or self-powered luminous signs shall not be used. Chloride, Dual-Lite, Emergi-Lite, Exide Lightguard, Lightalarms, Lithonia, LSI Industries, Morelite, Prescolite, or Sure-Lites.
 - 1. LED's shall be wired in parallel to prevent multi-lamp failure, and shall be concealed within the sign by a clear panel and red optical diffuser. Power consumption shall not exceed 2 watts per face.
 - 2. Exit signs shall have white die cast aluminum or polycarbonate housings with universal mounting brackets; brushed aluminum stencil faces with red letters and multidirectional knockout arrows.
 - 3. Exit signs shall be provided with emergency battery packs and battery chargers when required. Batteries shall be maintenance-free nickel cadmium, and shall be mounted within the signs.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

- A. Support recessed troffers independently of the ceiling grid system by using two safety wires minimum on diagonally opposite corners of the fixtures. Support recessed downlights by using safety wires or by rigidly attaching the fixtures to the building structure or ceiling grid system. Removable T-bar clips shall not be used to attach fixtures to the ceiling grid system.
- B. Install fixtures level, with no gaps between adjacent fixtures or between fixtures and surrounding surfaces. Lenses, reflectors, and trims of fixtures shall be properly and uniformly aligned.
- C. Where fixtures are shown with dual switches, control all inner lamps with one switch and all outer lamps with the other switch. Where dimming or occupancy sensor-controlled fixtures are shown, control the fixtures in accordance with the appropriate wiring diagram or manufacturer's instructions.
- D. Connect night light fixtures and emergency lighting fixtures to the hot (unswitched) side of lighting circuits.
- E. Provide an individual feed with ground conductor from a junction box to each lighting fixture. Lighting fixtures shall not be daisy-chained.
- F. Drops to recessed fixtures may be flexible metallic conduit, or manufactured wiring systems may be used where accessible. Fixtures shall be provided with sufficient length to permit removal and lowering of the fixtures 12" below the ceiling.
- G. Provide green grounding conductors back to the panel ground for lighting circuits. Raceways shall not be used as grounding conductors.
- H. Fixtures shall have their exterior labels removed and shall be thoroughly cleaned. Burned out lamps shall be replaced.
- I. Locate emergency lighting remote battery packs and remote test/monitor modules identically so their status indicating lights are visible to the public and they form a straight line when viewed from the end of the corridor or room. Where a suspended ceiling exists, center the status indicating lights in adjacent ceiling tiles.
- J. Mount sealed beam emergency lighting units where shown and aim their lamps to light the egress path as uniformly as possible.
- K. When emergency lighting fixtures contain audible alarms, disable the alarms in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

- A. Perform a visual inspection to verify cleanliness and alignment of the fixtures. Misalignment and light leaks shall be corrected, and rattles due to ventilation system vibration shall be eliminated.
- B. Perform an operational test to verify that all fixtures illuminate properly, dimming systems dim properly (i.e. no flicker), and lighting zones are switched according to the drawings.

3.3 COMMISSIONING

- A. Perform Commissioning activities in accordance with Section 01 91 00 – Commissioning.

3.4 TRAINING

- A. Provide a qualified service technician from the Manufacturer's staff to provide training.
- B. Train Owner's maintenance personnel on equipment operation, startup and shutdown, troubleshooting, servicing, and preventative maintenance procedures. Review the data contained in the Operating and Maintenance Manuals with Owner's personnel. Training shall occur separate from startup activities. 1. Provide 2 hours of on-site training minimum.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Exterior luminaires with lamps and ballasts.
 - 2. Luminaire-mounted photoelectric relays.
 - 3. Poles and accessories.
- B. Related Sections include the following:
 - 1. Section 01 78 43 - Spare Parts: Spare lamps for exterior and interior lighting fixture lamps.
 - 2. Division 26 Section 26 51 00 - Interior Lighting: Exterior luminaires normally mounted on exterior surfaces of buildings.

1.2 DEFINITIONS

- A. CRI: Color-rendering index.
- B. Luminaire: Complete lighting fixture, including ballast housing if provided.
- C. Pole: Luminaire support structure, including tower used for large area illumination.
- D. Standard: Same definition as "Pole" above.

1.3 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.
- B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4.
- C. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4.
- D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.
 - 1. Refer to Structural Drawing S1.1 – for wind speed data.

1.4 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - 2. Details of attaching luminaires and accessories.
 - 3. Details of installation and construction.
 - 4. Luminaire materials.
 - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - 6. Photoelectric relays.
 - 7. Ballasts, including energy-efficiency data.
 - 8. Lamps, including life, output, and energy-efficiency data.

9. Materials, dimensions, and finishes of poles.
 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 11. Anchor bolts for poles.
- B. Shop Drawings:
1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 2. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
 3. Wiring Diagrams: Power and control wiring.
- C. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For luminaires to include in emergency, operation, and maintenance manuals.

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. 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 IEEE C2, "National Electrical Safety Code."
- D. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- B. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
- C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three-years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Fixtures shall be as specified on the Drawings.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. 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.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Lamps: Comply with the standard of the ANSI C78 series that is applicable to each type of lamp. Provide luminaires with indicated lamps of designated type, characteristics, and wattage. Where a lamp is not indicated for a luminaire, provide medium wattage lamp recommended by manufacturer for luminaire.
- M. Metal-Halide Color Temperature and Minimum Color-Rendering Index: 3600 K and 70 CRI, unless otherwise indicated.

1. Refer to Section 01 78 43 - Spare Parts for extra lamps.
- N. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- O. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.

2.3 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4.
 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 1. Materials: Shall not cause galvanic action at contact points.
 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
 3. Anchor-Bolt Template: Plywood or steel.
- D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

2.4 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; 1-piece construction up to 40 feet in height with access handhole in pole wall.
- B. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section 26 05 26 - Grounding and Bonding for Electrical Systems, listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- C. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- D. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.
- E. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

2.5 REQUIREMENTS FOR INDIVIDUAL EXTERIOR LIGHTING DEVICES

- A. Exterior Lighting Device shall be as specified on Drawing E1.1. No substitutions are allowed.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming-

3.2 POLE INSTALLATION

- A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section 03 30 00 - Cast-in-Place Concrete.
- C. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 3. Install base covers, unless otherwise indicated.
 4. Use a short piece of 1/2-inch- diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- D. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch below top of concrete slab.
- E. Raise and set poles using web fabric slings (not chain or cable).

3.3 BOLLARD LUMINAIRE INSTALLATION

- A. Align units for optimum directional alignment of light distribution.

3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section 26 05 26 Grounding and Bonding for Electrical Systems.
 - 1. Install grounding electrode for each pole, unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Division 26 Section 26 05 26 Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor and conductor protector.
 - 3. Ground metallic components of pole accessories and foundations.

3.6 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
- C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices. Refer to Section 01 79 00 Demonstration and Training."

END OF SECTION

**SECTION 31 1000
SITE CLEARING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of existing debris.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 01 5713 - Temporary Erosion and Sediment Control.
- D. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
- E. Section 02 4100 - Demolition: Removal of built elements and utilities.
- F. Section 31 2200 - Grading: Topsoil removal.
- G. Section 31 2200 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SITE CLEARING

- A. Comply with other requirements specified in Section 01 7000.
- B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.02 EXISTING UTILITIES AND BUILT ELEMENTS

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Protect existing structures and other elements that are not to be removed.

3.03 DEBRIS

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 31 2200

GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal and storage and re-spread of topsoil.
 - 1. Rough grading the site for building pad, sidewalks, parking paving, mechanical pads, etc..
 - 2. Finish grading and topsoil placement throughout the entire course of construction of the project.

1.02 PROJECT CONDITIONS

- A. Protect above- and below-grade utilities that remain.
- B. Protect plants, lawns, and other features to remain as a portion of final landscaping.
- C. Protect bench marks, survey control points, existing structures, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: See Section 31 2323.
- B. Other Fill Materials: See Section 31 2323.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Locate, identify, and protect from damage above- and below-grade utilities to remain.
- D. Notify utility company to remove and relocate utilities.
- E. Protect site features to remain, including but not limited to bench marks and survey control points, from damage by grading equipment and vehicular traffic.

3.03 ROUGH GRADING

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil when wet.
- C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
- E. See Section 31 2323 for filling procedures.
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

- A. Stockpile suitable topsoil to be re-used on site; remove remainder from site.
- B. If suitable for re-use, stockpile subsoil to be re-used on site; remove remainder from site. Remove from site any unsuitable subsoil.
- C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.

3.05 FINISH GRADING

- A. Finish grading and topsoil placement shall occur throughout the course of construction of the entire project, as directed by the Construction Manager.
- B. Before Finish Grading:

1. Verify building and trench backfilling have been inspected.
 2. Verify subgrade has been contoured and compacted.
- C. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.
- D. Where topsoil is to be placed, scarify surface to depth of 3 inches.
- E. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 6 inches.
- F. Place topsoil in areas where sodding are indicated.
- G. Place topsoil where required to level finish grade.
- H. Place topsoil to the following compacted thicknesses:
1. Areas to be Seeded with Grass: 6 inches.
 2. Areas to be Sodded: 4 inches.
 3. Shrub Beds: 18 inches.
 4. Flower Beds: 12 inches.
 5. Planter Boxes: To within 3 inches of box rim.
- I. Place topsoil during dry weather.
- J. Remove roots, weeds, rocks, and foreign material while spreading.
- K. Near plants spread topsoil manually to prevent damage.
- L. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- M. Lightly compact placed topsoil.

3.06 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) (30 mm) from required elevation.
- B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch) (13 mm).
- C. Top Surface of Subgrade: Plus or minus 1/10 foot (30 mm) from required elevation.
- D. Top Surface of Finish Grade: Plus or minus 1/2 inch (13 mm).

3.07 REPAIR AND RESTORATION

- A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.
- B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from The Architect as to remedy.
- C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.08 FIELD QUALITY CONTROL

- A. See Section 31 2323 for compaction density testing.

3.09 CLEANING

- A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

**SECTION 31 2316
EXCAVATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating for building volume below grade, footings, slabs-on-grade, paving, and utilities within the building.

1.02 RELATED REQUIREMENTS

- A. Section 31 2316.13 - Trenching: Excavating for utility trenches.
- B. Section 31 2323 - Fill: Fill materials, backfilling, and compacting.

1.03 PRICE AND PAYMENT PROCEDURES

- A. See Section 01 2200 - Unit Prices, for general requirements applicable to unit prices for undercut excavation.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Bedding and Fill to Correct Over-Excavation:
 1. See Section 31 2323 for bedding and corrective fill materials at general excavations.
 2. See Section 31 2316.13 for bedding and corrective fill materials at utility trenches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Notify utility company to remove and relocate utilities if required.
- D. Protect bench marks and survey control points from excavating equipment and vehicular traffic.
- E. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Architect.

3.03 EXCAVATING

- A. Excavate to accommodate new structures and construction operations.
- B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Provide temporary means and methods, as required, to remove all water from excavations until directed by Architect. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 UNDERCUT EXCAVATION

- A. Undercut 2 feet below footings, pad footings and slab area.
- B. See Section 01 2200 Unit Prices.
- C. Refer to structural documents for footing depths.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

- B. Provide for visual inspection of load-bearing excavated surfaces by Architect before placement of foundations.

3.06 PROTECTION

- A. Divert surface flow from rains or water discharges from the excavation.
- B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.
- D. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- E. Keep excavations free of standing water and completely free of water during concrete placement.

END OF SECTION

SECTION 31 2316.13

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 REFERENCES

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2007.
- C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2009.
- E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- F. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- G. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where designated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
 - 4. Verify that survey bench marks and intended elevations for the Work are as indicated.
 - 5. Protect plants, lawns, and other features to remain.
 - 6. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill: Conforming to State of Arkansas Highway Department standard.
- B. Refer to Section 31 2323 Fill for required fill materials.
- C. Structural Fill: Conforming to State of Arkansas Highway Department standard.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 2200 for additional requirements.
- C. Locate, identify, and protect utilities that remain and protect from damage.

3.03 TRENCHING

- A. Notify Matt Silas Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
- G. Remove excavated material that is unsuitable for re-use from site.
- H. Remove excess excavated material from site.

3.04 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Slope grade away from building minimum 2 inches in 10 ft (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- F. Correct areas that are over-excavated.
 - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
 - 2. Compaction Density Unless Otherwise Specified or Indicated:
 - a. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
 - b. At other locations: 95 percent of maximum dry density.
 - 3. Reshape and re-compact fills subjected to vehicular traffic.

3.06 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Utility Piping, Conduits, and Duct Bank:
 - 1. Bedding: Use general fill.
 - 2. Cover with general fill.
 - 3. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.
- C. Over Subdrainage Piping at Foundation Perimeter:
 - 1. Bedding: Drainage fill and geotextile fabric.
 - 2. Cover drainage fill with general fill.

3.07 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch (25 mm) from required elevations.

3.08 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- C. Evaluate results in relation to compaction curve determined by testing un-compacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.09 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

**SECTION 31 2323
FILL AND BACKFILL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling, and compacting for footings, slabs-on-grade, paving, and utilities within the building.
- B. Backfilling and compacting for utilities outside the building to utility main connections.
- C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.
- D. Filling excavations generated from removal of soft spots on site.

1.02 DEFINITIONS

- A. Finish Grade Elevations: Indicated on civil drawings.
- B. Subgrade Elevations: 4 inches (100 mm) below finish grade elevations indicated on drawings, unless otherwise indicated.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill:
 - 1. Compaction: 95% Modified Proctor.
 - 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
 - 3. On-site or off-site fill shall consist of Sandy Clay (CL); Clayey Sand (SC); Silty Sand (SM) and/or Clayey Gravel (GC) conforming to the description included in ASTM D2487.
 - a. Structural Fill:
 - 1) Compaction: 95% Modified Proctor.
 - 2) Off-site fill shall consist of Silty Sand (SM); Sandy Clay (CL); Clayey Sand SC); and/or Clayey Gravel (GC) conforming to the description included in ASTM D2487.
 - b. Concrete for Fill: Minimum compressive strength of 2500 psi at 28 days.
 - 4. Granular Fill, Drainage Fill, or Capillary Water Barrier indicated under concrete floor slabs shall consist of a four inch layer of No. 57 aggregate; or a concrete sand conforming to ASTM C33; or a naturally occurring granular material, provided material has less than 5% passing through a No. 200 sieve.
 - a. Sand: Conforming to State of Arkansas Highway Department standard.
 - 5. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay, or impurities, plants, weeds and roots; Acidity range (pH) of minimum 5.5 and maximum 7.0.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 2200 for additional requirements.

3.02 PREPARATION

- A. Scarify subgrade surface to a depth of 6 inches (150 mm) to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- H. Slope grade away from building minimum 2 inches in 10 ft (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
 - 1. Load-bearing foundation surfaces: Use structural fill, flush to required elevation, compacted to 100 percent of maximum dry density.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- J. Compaction Density Unless Otherwise Specified or Indicated on Drawings:
 - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
 - 2. At other locations: 95 percent of maximum dry density.
- K. Reshape and re-compact fills subjected to vehicular traffic.

3.04 TOLERANCES

- A. Top Surface of General Filling: Plus or minus 1 inch (25 mm) from required elevations.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.
- B. Perform density testing on compacted fill in accordance with applicable references.

1. General Fill: 95 percent modified proctor.
- C. Evaluate results in relation to compaction curve determined by testing un-compacted material in accordance with ASTM D1557 - Modified Proctor as follows:
 1. General Fill: 95% modified proctor.
 2. Structural Fill: 95% modified proctor.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Proof roll compacted fill at surfaces that will be under slabs-on-grade.

3.06 CLEANING

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

**SECTION 31 3116
SOIL TREATMENT FOR TERMITE CONTROL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Chemical soil treatment.

1.02 REFERENCE STANDARDS

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; United States Code; 1947 (Revised 2001).

1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Test Reports: Indicate regulatory agency approval reports when required.
- D. Manufacturer's Application Instructions: Indicate caution requirements.
- E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
- F. Record moisture content of soil before application.
- G. Maintenance Data: Indicate re-treatment schedule.
- H. Warranty: Submit warranty and ensure that forms have been completed in the Owner's name.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing this type of work and:
 - 1. Having minimum of five years documented experience.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year installer's warranty against damage to building caused by termites.
 - 1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.
 - 2. Inspect annually and report in writing to the Owner. Provide inspection service for five years from Date of Substantial Completion, at no extra cost.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Manufacturers:
 - 1. Terminix
 - 2. Coordinate termite control company with the Owner.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Toxicant Chemical: EPA approved; synthetically color dyed to permit visual identification of treated soil.

2.02 MIXES

- A. Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

3.02 APPLICATION

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Apply toxicant at following locations:
 - 1. Under Slabs-on-Grade.
 - 2. At Both Sides of Foundation Surface.
- D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.
- E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.
- F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- G. Re-treat disturbed treated soil with same toxicant as original treatment.
- H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

- A. Do not permit soil grading over treated work.

END OF SECTION

**SECTION 32 1123
AGGREGATE BASE COURSES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course.
- B. Paving aggregates.

1.02 REFERENCE STANDARDS

- A. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- B. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- D. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- E. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Aggregate Composition Test Reports: Results of laboratory tests on actual materials used.
- D. Compaction Density Test Reports.

1.04 DELIVERY, STORAGE AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When aggregate materials need to be stored on site, locate stockpiles where designated.
 - 1. Prevent contamination.
 - 2. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

2.01 MATERIALS

- A. A. Aggregate : Coarse aggregate, conforming to State of Arkansas Highway and Transportation Department, Class 7 Aggregate standard specifications.
- B. Fine Aggregate : Sand; conforming to State of Arkansas Highway Department standard.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.
- B. Where aggregate materials are specified using ASTM D2487 classification, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

- A. Under Bituminous Concrete Paving:
 - 1. Place AHTD Class 7 aggregate to a minimum total compacted thickness as shown on Civil Drawings.
 - 2. Compact to 95 percent of maximum dry density.
- B. Under Portland Cement Concrete Paving:
 - 1. No aggregate base is required under portland cement concrete paving.
- C. Level and contour surfaces to elevations and gradients indicated.
- D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.
- B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D2922 and ASTM 03017.
- C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 1557 ("modified Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests: Minimum 3 tests per lift and 1 additional test per 5,000 sq. ft. thereafter.
- F. Proof roll compacted aggregate at surfaces that will be under concrete slabs-on-grade and pavement.

3.06 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

**SECTION 32 1216
ASPHALT PAVING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single course bituminous concrete paving (ACHM).
- B. As indicated on Civil Drawings.
- C. Surface sealer.

1.02 REFERENCE STANDARDS

- A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute; 1997.
- B. AI MS-19 - A Basic Asphalt Emulsion Manual; The Asphalt Institute; Fourth Edition.
- C. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Arkansas Highways standard.
- B. Mixing Plant: Conform to State of Arkansas Highways standard.
- C. Obtain materials from same source throughout.

1.04 FIELD CONDITIONS

- A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.
- B. Place bitumen mixture when temperature is not more than 15 F degrees (8 C degrees) below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Asphalt Cement: In accordance with state of Arkansas Highway and Transportation Department's Standard Specifications.
- B. Aggregate for Wearing Course: In accordance with State of Arkansas Highway and Transportation Department Standard Specifications.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

- A. Base Course: State of Arkansas Highway standards.
- B. Wearing Course: State of Arkansas Highway standards.

2.03 SOURCE QUALITY CONTROL

- A. Test mix design and samples in accordance with State of Arkansas Highway standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that compacted subgrade and granular base is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE

- A. Place and compact base course.
- B. Section 32 1123 - Aggregate Base Courses.

3.03 PREPARATION - PRIMER

- A. Apply primer in accordance with State of Arkansas Highway standards.

- B. Use clean sand to blot excess primer.

3.04 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with manufacturer's instructions.
- B. Apply tack coat to contact surfaces of curbs, gutters and longitudinal and transverse joints.
- C. Coat surfaces of manhole, catch basin, and metallic surface frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.05 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place asphalt binder course within 24 hours of applying primer or tack coat.

PLACE BINDER COURSE TO THICKNESS IDENTIFIED IN SCHEDULE AT END OF SECTION.

**SECTION 32 1313
CONCRETE PAVING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete sidewalks, integral curbs, and gutters.
- B. Mechanical pads.

1.02 RELATED REQUIREMENTS

- A. Section 03 2000 - Concrete Reinforcing.
- B. Section 03 3000 - Cast-in-Place Concrete.
- C. Section 07 9005 - Joint Sealers: Sealant for joints.
- D. Section 09 9000 - Painting and Coating: Pavement markings.
- E. Section 31 2200 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.
- F. Section 32 1216 - Asphalt Paving.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
- B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
- C. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.
- D. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2012.
- F. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2012a.
- G. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2012.
- H. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.
- I. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2010b.
- J. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- K. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2008).
- L. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2008).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on joint filler, admixtures, and curing compound.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with State of Arkansas Highways standard.
- B. Obtain cementitious materials from same source throughout.
- C. Follow recommendations of ACI 305R when concreting during hot weather.

- D. Follow recommendations of ACI 306R when concreting during cold weather.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not place concrete when base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Form Materials: Conform to ACI 301.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751).
- C. Thickness: 1/2 inch.

2.02 REINFORCEMENT

- A. Reinforcing Steel and Welded Wire Reinforcement: Types specified in the construction drawings.

2.03 CONCRETE MATERIALS

- A. Concrete Materials: Provide in accordance with State of Arkansas Highways Standard Specifications

2.04 ACCESSORIES

- A. Curing Compound: ASTM C 309, Type 1, Class A.

2.05 CONCRETE MIX DESIGN

- A. Refer to civil and structural drawings for notes and details by regarding Concrete Mix Design.
- B. Admixtures: Acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer when approved by the Civil Engineer.
- C. Concrete Properties:
 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 psi.
 2. Fly Ash Content: Not Allowed.
 3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
 4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
 5. Cement Content: Minimum 5 1/2 sack per cubic yard mixture.
 6. Water-Cement Ratio: Maximum 40 percent by weight.
 7. Total Air Content: 5 plus or minus 1 percent, determined in accordance with ASTM C173/C173M.
 8. Maximum Slump: 5 inches.
 9. Maximum Aggregate Size: 1-1/2 inch.

2.06 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

- A. See Section 32 1123 for construction of base course for work of this Section.

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat metallic surfaces of manhole, catch basin, and protected inlets frames with oil to prevent bond with concrete pavement.

- C. Notify the Architect minimum 24 hours prior to commencement of concreting operations.

3.04 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

- A. Place reinforcement at midheight of slabs-on-grade.
- B. Interrupt reinforcement at contraction joints.
- C. Place dowels to achieve pavement and curb alignment as detailed.
- D. Provide doweled joints 12 inch on center with one end of dowel set in capped sleeve to allow longitudinal movement.

3.06 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

3.07 PLACING CONCRETE

- A. Place concrete in accordance with State of Arkansas Highways standards.
- B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.08 JOINTS

- A. Align curb, gutter, and sidewalk joints.
- B. Place 3/8 inch wide expansion joints at 18 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
 - 1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
 - 2. Secure to resist movement by wet concrete.
- C. Provide sawn joints:
 - 1. At intervals matching width of walk in sidewalks.
 - 2. See drawings for layout.
- D. Saw cut contraction joints 1/4 inch wide within 8 hours. Cut 1/3 into depth of slab.

3.09 FINISHING

- A. Area Paving: Light broom, texture perpendicular to pavement direction.
- B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch (6 mm) radius.
- C. Median Barrier: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.
- D. Curbs and Gutters: Light broom, texture parallel to pavement direction.
- E. Inclined Vehicular Ramps: Broomed perpendicular to slope.
- F. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions

3.10 JOINT SEALING

- A. Seal joints as per manufacturer's instructions.

3.11 TOLERANCES

- A. Maximum Variation of Surface Flatness: 1/4 inch (6 mm) in 10 ft (3 m).
- B. Maximum Variation From True Position: 1/4 inch (6 mm).

3.12 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000.
 - 1. Provide free access to concrete operations at project site and cooperate with appointed firm.
 - 2. Submit proposed mix design of each class of concrete to Architect and testing firm for review prior to commencement of concrete operations.
 - 3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- B. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure four concrete test cylinders. Obtain test samples for every 50 cu yd or less of each class of concrete placed each day.
 - 1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 - 2. Perform one slump test for each set of test cylinders taken.
- C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.13 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit vehicular traffic over pavement until 75 percent design strength of concrete has been achieved.

3.14 SCHEDULES

- A. Refer to Contact Drawings for scheduled areas of paving.
- B. As a minimum, provide concrete walks, mechanical pads, etc: Standard 4,000 psi 28 day concrete, 4 inches thick, 6 x 6 W2.9 x W2.9 sheet mesh reinforcement on specified aggregate base, light broom finish.
- C. Unless noted otherwise on Drawings, provide handicap parking and other parking/drive areas shall be 4,000 psi 28 day concrete, 5 inches thick, with 6x6 W2.9 x W2.9 sheet mesh reinforcing on specified aggregate base, float finish.

END OF SECTION

**SECTION 32 1723.13
PAINTED PAVEMENT MARKINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Parking lot markings, including parking bays and handicapped symbols.

1.02 REFERENCE STANDARDS

- A. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- B. FHWA MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways; U.S. Department of Transportation, Federal Highway Administration; Current Edition.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver paint in containers of at least 5 gallons (18 L) accompanied by batch certificate.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.04 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Line and Zone Marking Paint: MPI (APL) No. 97 Latex Traffic Marking Paint; color(s) as indicated.
 - 1. Parking Lots: White.
 - 2. Handicapped Symbols: Blue.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Clean surfaces thoroughly prior to installation.
 - 1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.
- D. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.
- E. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

3.03 INSTALLATION

- A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

- B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F (10 degrees C) or more than 95 degrees F (35 degrees C).
- C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.
- D. Comply with FHWA MUTCD manual (<http://mutcd.fhwa.dot.gov>) for details not shown.
- E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.
- F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on drawings true, sharp edges and ends.
 - 1. Apply paint in one coat only.
 - 2. Wet Film Thickness: 0.015 inch (0.4 mm), minimum.
 - 3. Width Tolerance: Plus or minus 1/8 inch (3 mm).
- G. Parking Lots: Apply parking space lines, entrance and exit arrows (if applicable), painted curbs (if applicable), and other markings indicated on drawings.
 - 1. Mark the International Handicapped Symbol at indicated parking spaces.
 - 2. Hand application by pneumatic spray is acceptable.
- H. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.04 DRYING, PROTECTION, AND REPLACEMENT

- A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.
- B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.
- C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.
- D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.
- E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

END OF SECTION